March-April 1953

METAL TREATING

THE *Only* MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

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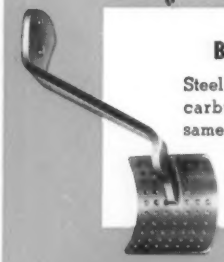

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Editorial...

MORE WASTE CAUSED BY IGNORANCE

Our attention has been called to a news item citing a specific example of not only a tremendous financial loss, but the complete failure of a manufacturer to fill a prime contract involving much needed weapons for Korea.

The entire failure hinged on the granting of the contract without properly investigating the ability of the manufacturer to perform the most vital operation in the entire process, namely, heat treating. The corporation awarded the contract admittedly, "had no experience in heat treating" and received the contract in spite of warnings from the Pentagon that, "only the best qualified, proven contractor be assigned this critical work."

As a result of hasty, unnecessary installation of heat treating equipment and inexperienced, unskilled operation of the equipment, some million and one half rocket launcher tubes were rendered useless.

Here is another classic example (of which there are all too many in recent years) of the failure to recognize or accept the fact that heat treating is a truly *vital* link in the production chain.

Every reputable manufacturer with established and successful heat treating facilities and every commercial heat treating organization should pool their interests and combine their efforts to prevent these wasteful, and even tragic errors.

C. E. Herington

METAL TREATING

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National Trade Association of Commercial Heat Treaters

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Some Recent Alloy Steels and Their Heat Treatment

By WILLIAM C. MEARNS, *Central Atlantic Coast Technical Section, Development & Research Division International Nickel Company, New York City*

The purpose of this article is to discuss briefly the composition, properties and heat treatment of two interesting types of alloy steel which have recently found application in special fields.

"Age Hardening" Steels

The first type is distinguished by the ability to "self harden" during the tempering operation. Parts are given the usual quenching and tempering treatment which leave them in a semi-hardened condition, permitting machining operations. They are then finished machined to final dimensions after which they are "age hardened" by a long time hold at a temperature ranging between 950°F. and 1050°F. This causes a change from the solution condition obtained by the initial quench and temper into the fully hardened condition resulting from precipitation. The metallurgical theory is similar to that well-known in the treatment of many aluminum alloys.

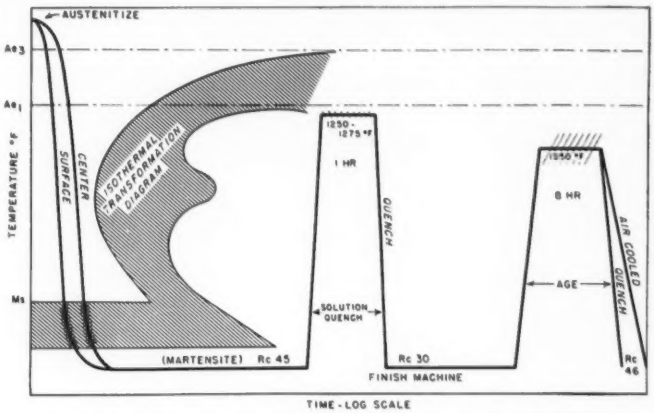

Fig. 1—Chart showing quenching and hardening treatment for 5% nickel—2% aluminum steel.

A steel of closely similar composition has been known for many years under the trade name NITRALLOY N. Its behavior is that described above and it was developed with the purpose of permitting self-hardening during the nitriding operation.

Both of the steels resemble the 4300 series with the exception that the nickel content is about doubled and there is an addition of about one percent of aluminum. Table I gives their typical composition for comparison.

TABLE I

	Age Hardening	Nitralloy N	4300 Series
Carbon	.20- .27	.27	
Manganese	.40- .70	.67	.45- .65
Nickel	3.25-3.75	3.60	1.65-2.00
Chromium	1.00-1.30	1.24	.40- .60
Molybdenum	.20- .30	.25	.20- .30
Aluminum	1.10-1.40	.92	—

Similar heat treating results can be obtained with another variation of this self-hardening steel of the composition given in Table II. This it will be seen, closely resembles the five per cent nickel steel known as SAE 2520, except that about two and a quarter per cent aluminum is added. The heat treatment of these steels is illustrated in the graph, Figure 1.

TABLE II

	Age Hardening	2520
Carbon	.22	.20
Manganese	.35	.45- .60
Silicon	.24	
Nickel	5.70	4.75-5.25
Aluminum	2.25	

The left hand portion illustrates diagrammatically the conventional quenching and tempering treatments, relative to the isothermal transformation diagram. Instead, however, of a low tempering treatment after the quench, to retain maximum hardness, these age hardening steels are re-heated in the range 1200°F. to 1275°F. This leaves them with a Rockwell hardness of about C 25 to C 30 and final machining operations are then done. After this, the piece is reheated for an aging period in the range 950°F. to 1050°F. and allowed to cool by quenching, by air cooling or in the furnace, as may be required. Such treatment develops a hardness in the range Rockwell C 40 to C 46. Practically no deformation occurs.

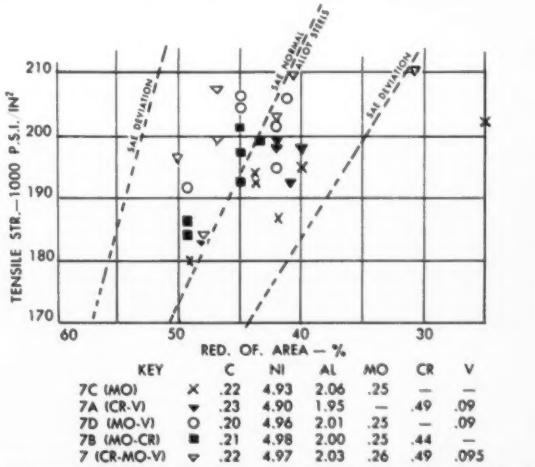

Fig. 2—Tensile strength and reduction of area of precipitation-hardened steel vs. standard S.A.E.—A.I.S.I. steels.

The left hand portion illustrates diagrammatically the conventional quenching and tempering treatments, relative to the isothermal transformation diagram. Instead, however, of a low tempering treatment after the quench, to retain maximum hardness, these age hardening steels are re-heated in the range 1200°F. to 1275°F. This leaves them with a Rockwell hardness of about C 25 to C 30 and final machining operations are then done. After this, the piece is reheated for an aging period in the range 950°F. to 1050°F. and allowed to cool by quenching, by air cooling or in the furnace, as may be required. Such treatment develops a hardness in the range Rockwell C 40 to C 46. Practically no deformation occurs.

TABLE III

Compositions					Solution Quenching	Solution Quenched Hardness Rock. "C"	Aging Temp., Time and Maximum Rock. "C"					
							950°F.		1000°F.		1050°F.	
C	Ni	Al	Cr	Mo			Rc	Hrs.	Rc	Hrs.	Rc	Hrs.
.22	5.70	2.25	—	—	1600°F.* 1275°F.**	26	43	8	43 43	4 8		
.22	4.95	2.10	—	.25	1700°F.* 1275°F.**	27.5	39.5 42.5	2 8	42 44	1 8	41.5 42.5	1 8
.21	4.98	2.00	.44	.25	1700°F.* 1275°F.**	30	41 45	2 8	42 46	1 8	42.5 44.0	1 8
.25	3.63	.93	1.19	.24	1700°F.* 1200°F.**	28	41.5	48	32	32		

* Oil quenched after one hour at temperature
** Water quenched after one hour at temperature

TABLE IV

	Modified 4340	Ni-Cr-Mo-V
Carbon	.30	.30
Manganese	.90	.65
Silicon	.30	1.20
Chromium	.80	.50
Nickel	1.80	2.50
Molybdenum	.25	.50
Vanadium	.10	.20

If nitriding is done coincident with the aging operation, as has been the practice with NITRALLOY N, the usual nitrided case is developed and this is accompanied by growth on the surface of about 0.0005", or 0.001" of diameter. This growth has no relation to the cross section of the piece, being merely the result of absorption of nitrogen in the case, with accompanying volumetric growth thereof. Very close accuracies have been obtained by this process.

Typical compositions, heat treatment and hardnesses are given in Table III. Figure 2 gives comparative figures on tensile strength and reduction of area of several precipitation hardening steels as compared with standard SAE steels. Figure 3 illustrates a typical application of an age hardening steel in the form of a die. It should be remembered that such a die can be given a surface hardness in the range 900 to 1100 Vickers Brinell by nitriding.

Other applications of this type of steel are in gears, rolls, and many other parts which cannot be straightened, finished machined or other than very lightly ground after heat treatment.

It should be noted that the maximum age hardening effect depends to a certain extent upon the solution quenched hardness.

Extra High Strength Steels

The second type of novel steels represents a development resulting from research to produce satisfactory steels of higher strength and therefore greater lightness in the construction of aircraft, especially landing gear. With the tremendous increases in gross weight of large aircraft, steels having tensile strength values in the range 200,000 to 300,000 psi were desired. They must, of course, have adequate resistance to shock and overload and this must be true over the wide range of temperature to which aircraft are exposed. Authorities at Wright Field and others

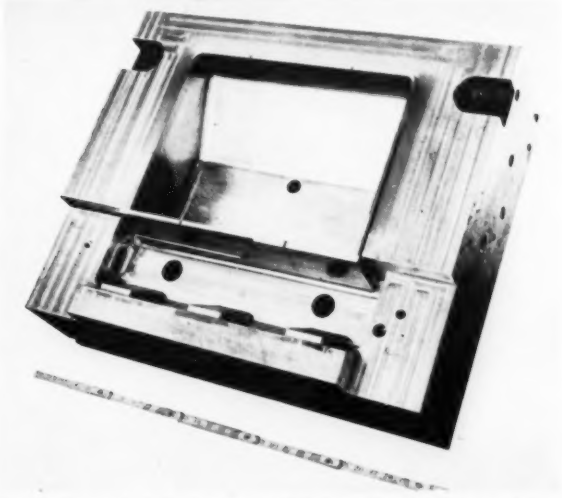

Fig. 3—Die made of Cascade No. 2 (nickel-aluminum) steel, a product of Latrobe Steel Company.

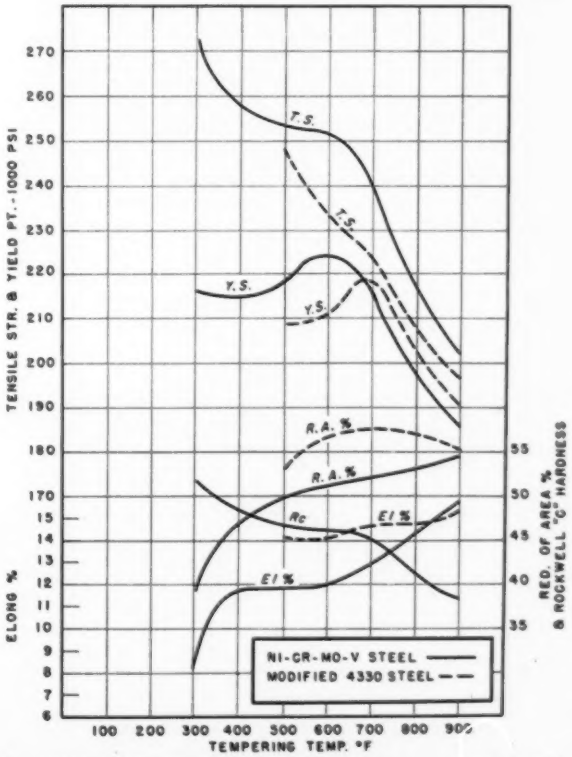

Fig. 4—Effect of tempering temperature on T.S., Y.P., % elong., Rc and reduction of area of oil quenched Ni-Cr-Mo-V and modified 4330 steels.

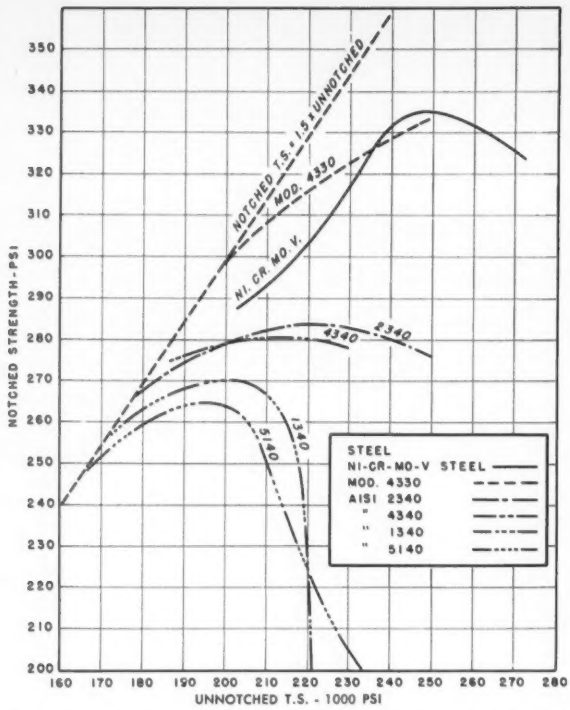

Fig. 5—Comparison of notched vs. unnotched strengths of high strength and some A.I.S.I. alloy steels of 40 carbon.

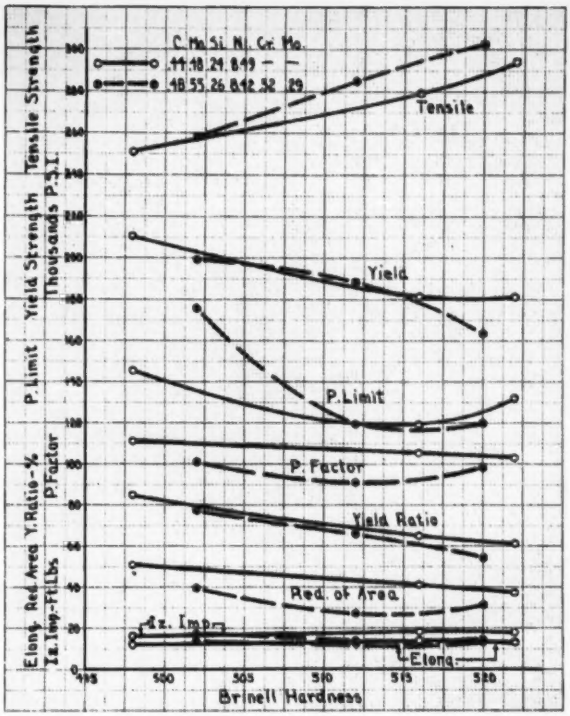

Fig. 6—Tensile and impact properties of oil quenched and tempered 8½ % nickel steels.

asked International Nickel Company as well as several steel manufacturers to work on this project. In order to assure that parts would accept some overload before breaking, usually in the form of bending, tests were conducted on the comparative properties of notched and unnotched tensile specimens. As a result, several compositions such as the two listed in Table IV were developed. Typical properties of these steels are illustrated in Figure 4. Figure 5 illustrates comparisons of notched versus unnotched tests. Observe how the notched strength drops off (in some steels) when the unnotched strength exceeds about 200,000 psi whereas the modified 4340 steel continues to hold a good ratio. It may be that a different heat treatment would change these conditions. The fact that the notched strength is considerably higher than the unnotched is, of course, accounted for by the fact that no necking down or reduction of area can take place. The chart, Figure 6, shows interesting graphs of the relation of the various properties with increased Brinell hardness.

There were some difficulties in using these steels, because to achieve the 235,000 psi tensile strength it is necessary to oil quench from 1600°F. and draw at moderate temperatures such as 600-700°F. This temperature is within the blue-brittle range for most steels. However, these steels do not show any appreciable degree of blue-brittleness, and recent specifications of the Aeronautical Material Specifications Committee recognize this, and a similar type of steel is incorporated in AMS 6427.

Machining at ordinary strength levels of the nickel-chromium-molybdenum-vanadium steels presents no more problems than the ordinary low alloy steels. However, after the steels are heat treated to the high strength levels they present an entirely different problem. All machining operations at the high strength level require carbide-tipped cutters. The most severe machining problem is the drilling and tapping of small holes.

Because of this difficulty, most production men consider making as many machine cuts as possible before heat treatment, and leave the minimum amount possible for final cuts after heat treatment. Clean, scale-free heat treatment is, of course, desirable. Freedom from surface decarburization is essential. Straightening and minor forming of these high strength steels can be accomplished cold in the same sense as other steel straightening operations but the introduction of residual stresses must be avoided.

These materials are flash welded at the plant of one leading aircraft company, using the same technique developed for other alloy steels with consistently good results. However, there has been little progress in developing a technique which gives dependable results for gas welding this material, although a metallic arc welding technique using coated rods has been developed which gives excellent results.

300,000 psi Steel

We have been asked numerous times concerning the development of a suitable steel for the 300,000 psi tensile strength range for landing gear. We are work-

(Continued on page 10)

Distortion Control and Hot Oil Quenching

By F. E. Harris, *Metallurgical Consultant*
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Detroit, Mich.

Rapid cooling from elevated temperatures is a requirement for the transformation control of steel parts. Distortion during the quench is connected with stresses set up in the part in question and distortion control is predicated on holding these stresses to a minimum. Generally speaking, it is possible to separate the factors contributing to stress formation and to indicate operational procedures which are helpful in control. Thus we may divide the stresses imposed on a quenched part into two broad classes, namely those caused by different cooling rates for various sections of the piece, and those imposed by non-uniform transformation in these sections. For example, the interrupted quench with the coolant at an elevated temperature is primarily concerned with alleviating non-uniform transformations. Yet any diminution of the difference between the temperature of the part as quenching begins and the temperature of the coolant bath lessens in itself the possibility of temperature differences in various sections as quenching proceeds; in general, the lower the temperature of the piece as quenched and the higher the temperature of the coolant, the less is the thermal shock and possible distortion of the quenched part.

Loading factors which favor uniform heating by convection also favor uniform quenching in the bath and these factors may be analyzed with mass production in mind. For uniform sections such as plates the tendency for distortion increases with the increase of ratio between area of the plate and the thickness of the section, and for a thin uniform section a "free" loading is often indicated. Such a loading, where the design of the part allows, is a suspension from a bar provided with spacing lugs which permits the parts to hang freely. The fluidity of the quenching medium controls the spacing; a more viscous medium requires greater spacing for uniform heat abstractions. When variable sections are encountered, it is often possible to compensate for the lighter sections by fixturing or by appropriate location of the pieces with reference to each other. Generally each part requires a separate study. However, the use of open base trays, with shrouded vertical sides promotes uniform transfer by convection, and adequate shrouding together with uniform and symmetrical loading favors both the heating and the quenching operations.

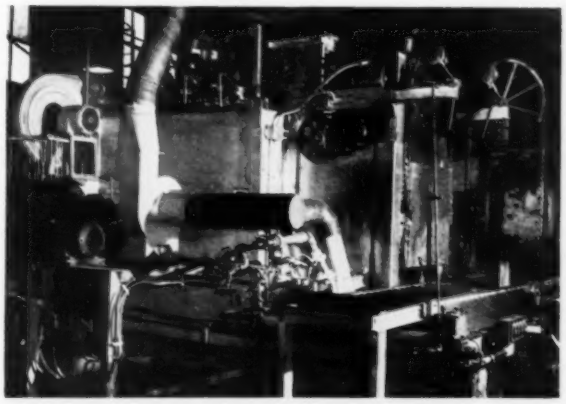


Fig. 2—The hot quenching equipment shown here provides for complete control of the quench bath.

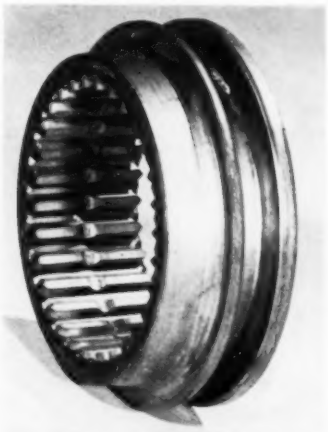


Fig. 1—This synchronizing ring is typical of parts with very low distortion allowances which can often be handled economically only by interrupted quenching.

Hot oil quenching requires, for practical operation, that due care be given to the bath heating as well as to the quenching arrangement. Excessive differentials between the heating surface and the oil will cause coking or thickening of the oil, especially when the bath circulation is inadequate. The use of radiant tube heating with large heat-transfer areas in comparison with the heating rate allows a moderate differential, particularly if the heating tubes are finned and if the oil circulation is properly directed. Adequate and controllable circulation through the shrouded container is attained by locating the charge, with a moderate speed lowerator, in position on sup-

(Continued on page 10)

Cleaning Precision Parts On A Jobbing Basis

By Eugene F. Anderson, *Special Engineer*
American Wheelabrator & Equipment Corp.
Mishawaka, Indiana

The wet blasting process for cleaning scale from precision-built parts has been receiving increased recognition by operators of commercial heat treat shops, not only from the standpoint of an extra service for customers, but of a source of extra profits for the shop as well. The wet blasting process is characterized by a very fine mesh abrasive in water suspension being thrown at high velocity on the work by means of compressed air, but since abrasives in the range of 80 to 2500 mesh are used, required tolerances on precise work are easily held. Tolerances of .0001" are held where necessary.

The procedure in many cases involving close-tolerance parts has been to give them a chemical treatment for oil removal at the heat treating shop, then return them to the customers to do their own scale removal, because of the difficulties involved. Cleaning of such work as dies or molds and tools, preparation of micro finishes, etc., has been done only by manual methods believing that they were the only methods offering close enough abrasion control to avoid damage to vulnerable areas like sharp edges, corners, knurling, and thin-walled sections. However, it has been realized that wet blasting offers even closer abrasion control than manual finishing and polishing, and since it can be done in only a fraction of the time, really important economies are available for the customer. (The average heat treat scale can be removed at the rate of about 75 to 100 square inches per minute by wet blasting with a ½ inch abrasive nozzle and $\frac{7}{32}$ inch air jet.)

It has been realized that many manufacturers of precision parts having their heat treating done commercially do not have enough volume of production to justify their own wet blasting equipment, so it is both economical and convenient for them to have the cleaning done on a jobbing basis at the heat treat shop. Then, if a mirror finish is desired on the part, as in the case of certain work like glass molds or plastic molds, it can be put on manually in the customer's shop in only a short time, because with scale removed, the finer abrasive papers can be applied immediately. There are no delays due to "loading" of the abrasive media and the need for frequent pointing of stones for cleaning crevices. Wet blasting leaves a perfectly uniform matte-type finish on the work, which is virtually free from directional lines, tool marks, and surface imperfections, so only a small amount of manual buffing is necessary.

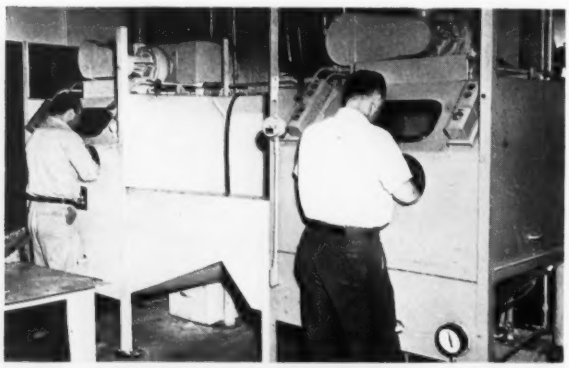


Fig. 1—View showing combination of two blasting machines with power rinse tank between. This combination eliminates much down time in commercial shops where variety of work makes the use of several abrasives necessary. Continuous tracks run the entire length of the assembly. Work car can be rolled from either side onto tank. One work car is sufficient to serve both machines, unless volume of work makes it necessary to operate both machines at once.

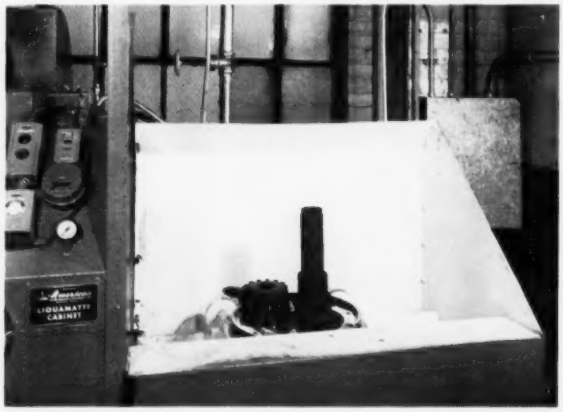


Fig. 2—View showing work car full of gears at Perfection Tool & Metal Heat Treating Company, 1740 W. Hubbard St., Chicago, Ill.

The Process

The wet blasting operation is done in cabinet-type machines. During blasting, the operator extends his arms through armholes on the front of the machine and manipulates the work and the abrasive gun inside with his hands while operating the compressed air valve for the abrasive gun with his knee. He is able to view the progress of the blasting through a vision window on the front, and he inserts and removes work from the cabinet through doors on the ends. However, in the case of small work like tools, gears, punches, etc., the operator can save himself a great deal of time by inserting and removing them through the armholes of the cabinet. Obviously, this can only be done if the gloves he wears are unattached to the gauntlets on the armholes, so unattached gloves have been more popular for this reason. They have also been more popular for reasons of health, since each man can have his own pair.

The abrasive is kept in suspension in the slurry by agitation furnished by either a pump or compressed air. The trend in abrasive agitation recently has been

Fig. 3—View of blasting compartment in the machine shown in Figure 2.

toward the use of vertical centrifugal pumps, since they require much less power than compressed air (½ H.P. against 2 to 5 H.P.) and require virtually none of the maintenance needed by horizontal-type pumps. After blasting, the parts are rinsed, with ferrous parts being rinsed in inhibited water.

Various models in machines and accessories are available, depending upon the job. The machines range from bench models approximately 30 inches in length to floor models over 6 feet in length. Some accommodate two operators at once. A type most popular with commercial heat treating shops is about 4 feet long and 3 feet wide, accommodating one operator at a time. A work car and turntable are employed for manipulating the work in the blasting compartment, and a power rinse tank attached to the machine receives the part for rinsing after the blast. The work car can be wheeled onto it from the blasting compartment by means of continuous tracks, and rinse water in the tank is sprayed over the work by means of a coolant-type pump. The tank and work car combination make it particularly easy to load and unload heavy work.

The abrasive most commonly used in commercial heat treating shops is 325 mesh, although due to the variety of work put through the machine, it is usually necessary to employ one or more other sizes, also. For forging dies and other work where extremely close surface control is unnecessary, 140 mesh abrasive is applicable. For work involving certain drawing dies, extrusion dies, and glass molds, it may be necessary to use as fine as 1250 mesh abrasive. To make for speedier operations and eliminate down time due to abrasive changes, many shops have adopted the combination of two blasting units, with one power rinse tank between. Each machine can be charged with a different size abrasive, yet one work car is sufficient to serve both machines, running the complete length via continuous tracks.

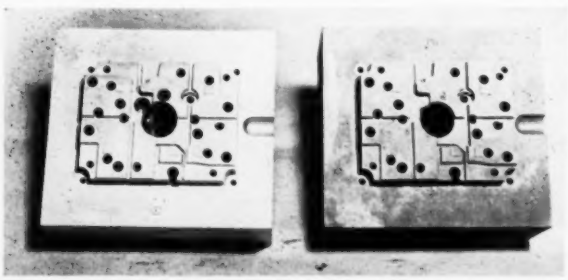


Fig. 4—Plastic mold punches like these, sized 4" x 4½" x 1¾" show effects of wet blasting. Part at right is covered with heat treat scale. Part at left was cleaned down to bright metal in seven minutes with 325 NE Liquabrasive. Sharp edges, corners, and flat surfaces were unaltered.

An important factor responsible for the popularity of the process has been the demonstration laboratories maintained by manufacturers of the equipment. Before investing in any equipment to do a certain job, it is possible for shops to have parts test cleaned in a laboratory to see which equipment design and which abrasive best does the required job.

Similarly many commercial shop owners have found the "free sample" method to be an effective way of promoting the process. Returning half of a customer's order in wet blasted condition and the remaining lot in the normal scale-covered condition usually results in the customer's proving to himself the advantages of purchasing the additional service.

Fig. 5—Comparison view of cabbage knockouts for forged ordnance shells. These are sized 6" high x 4½" diameter. The one at the right shows scaly and rusty condition after heat treating. The one at the left, inverted, is completely cleaned. Note threads. These were undamaged by the blasting operation.

Proof of the Pudding

One plastic mold manufacturer saved 32 hours of polishing and stoning time on a set of 16 mold punches. Heat treat scale on these parts, sized 4 inches by 4½ inches by 1¾ inches, was removed in seven minutes per part, using 325 mesh abrasive. Besides the time saving, the die maker reported that subsequent hand polishing was made easier, due to the absence of scale. Visibility was vastly improved.

A die casting company experienced a minimum of 10% savings by having its dies wet blasted after heat treatment. These dies are put into operation with no further surfacing performed on them. Cold spots, shiny spots and flow marks formerly experienced on the castings formed by paper-polished dies were completely eliminated with wet blasted dies.

(Continued on page 30)

"Excess Profits?" Or Is It "Excess Taxes?"*

A Bad Dream Raises Some Alarming Questions In A Citizen's Mind

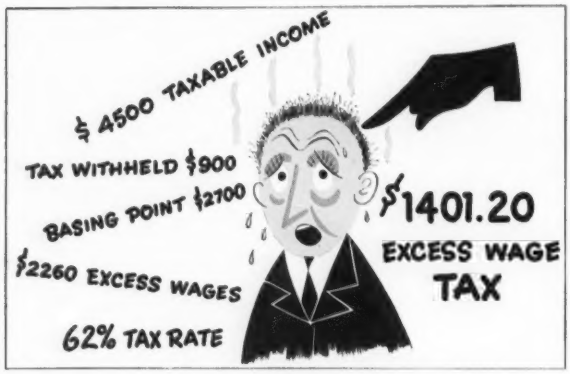
"Never heard of the Excess Wages Tax?" The Man Behind the Window exclaimed, in shocked surprise.

"I certainly haven't," said Harry Jones, "and it sounds ridiculous on its face. *Excess* wages, indeed! Whoever heard of *excess* wages?"

"I didn't make the law," said The Man. "I just work here. But ignorance," he added sternly, "is no excuse."

Harry Jones shook his head sadly at this reprimand, administered at the tax office to which he had been summoned by official writ.

"I thought I had paid my full tax for 1951," he



complained. "It was withheld from my paycheck. Now you tell me I owe a lot more!"

"You certainly do," said the Man Behind the Window, sharpening his pencil. "Come around here and I'll figure just how much."

Harry Jones spread his carefully kept notes on the Man's desk.

"In 1951," he said, "my taxable income came to $4500, even. You see that I paid my full tax of $900."

"That's what you think," said The Man. "What you made in 1951 is only one part of the story. Under the Excess Wages Tax, the important thing is how much your taxable income was in the three best years you had between 1946 and 1949—the three best years before the Korean War began."

"I wasn't working in 1946," said Harry Jones. "In 1947 my taxable income was $2500. In '48 it was only $2700, and in '49 it was $2900."

The Man's eyebrows arched.

"I had just started with the company," Harry Jones explained, "and my income as a beginner was small."

The Man made quick notations on a pad, humming to himself the while.

"Tum-tum-te-tum-tum-te," he said, softly. "So your taxable income was $2500, $2700 and $2900. Unfortunately, the autobiographical detail about your early struggles has no bearing on this case."

"It had a bearing on *my* case," said Harry Jones. "The $4500 taxable income I made in 1951 came after I'd had a promotion. And I'd had two cost-of-living raises. Things cost more now, you know."

"I know," said The Man, figuring rapidly. "Just wait 'til you see how much more *this* is going to cost you." He ran up a total on the adding machine and surveyed the results approvingly.

"Here's the way it looks," said The Man. He came around the desk and sat beside Harry Jones. "I'll explain it to you step by step. Or dollar by dollar, you might say.

In the years 1947, 1948, and 1949, your taxable income was $2500, $2700 and $2900, or an average of $2700. That's the total on which your Excess Wages Tax is figured. See?"

"No," said Harry Jones.

"Never mind," said The Man. "That's the amount. Now we'll put down 83 per cent of that, which comes to—let's see—comes to $2240, your base figure."

"So it does," said Harry Jones. "What does that mean?"

"You'll see," said The Man. "Tum-tum-tum-difference between $2240, which is 83 per cent of your normal income and the $4500 taxable income you made in 1951 is $2260."

"You're a whiz at subtraction," said Harry Jones, "but I don't . . ."

"You will," said The Man. "This $2260 is considered your 'excess wages.' Now we take 62 per cent or $1401.20 of that. Sixty-two per cent of 'excess wages' on top of the 20 per cent regular tax you've already paid brings your tax rate up to 82 per cent—same as corporations pay on 'excess profits'."

"You can't mean my tax rate is as high as a corporation's," said Harry Jones in doubtful voice.

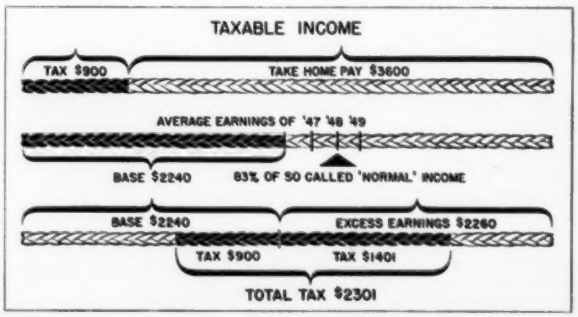
"Why not?" asked The Man reasonably. "What makes you think you should stand any less of the tax burden than the stockholders in American industry? Pay the cashier, $1401.20."

Harry Jones stared incredulously.

"You're insane," cried Harry Jones. "On $4500 taxable income you say I must pay $1401 Excess Wages Tax on top of the $900 regular income tax I've already paid?"

"It's not so bad," said The Man. "You don't want to profit from war, do you?"

Harry Jones rose from his chair, completely beyond



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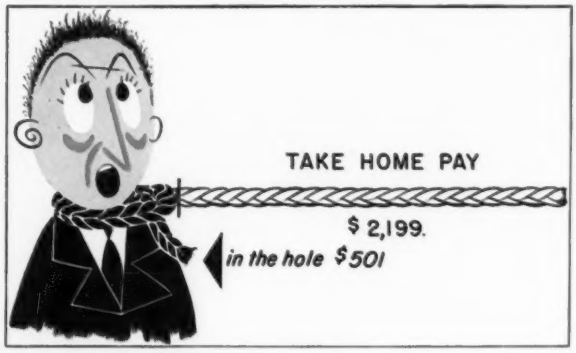
the capacity for speech. In his mind he was witnessing the collapse of the family's plans and aspirations. The new kitchen Mary had her heart set on—it would have to wait. The night-school university course in which he was preparing for a better job. The insurance premiums and savings account that were part of the program for the future.

"I'll be worse off financially than I was five years ago!" he cried when he had regained his voice.

"That's right," said The Man, wagging a finger. "Worse, and as for your complaints, under the law I must regard them as inconsequential, immaterial and unpatriotic."

It was at this moment that Harry Jones, with a piercing scream that aroused the neighborhood, fell out of bed and woke up.



This simple fable of Citizen Harry Jones, draws a close parallel with the problem of Employer Jones in trying to conduct a small business under the present so-called "Excess Profits Tax."

No real American, either an individual or a corporation, wants to make a killing on defense work, but businesses, as well as people, must have reasonable compensation for their efforts. They must be permitted to put something aside during good years to provide for the inevitable "rainy day," and for growth and improvement, as well as to develop new products. Businesses, as well as individuals, are entitled to reasonable compensation for *extra* effort and *extra* output.

To treat Citizen Jones as Employer Jones is treated, would destroy his initiative and ambition, if not his health and earning capacity. It does the same to Employer Jones.

The term "excess profits" once had political appeal, but the idea was pushed too far. It has actually retarded production, encouraged wastefulness, seriously weakened thousands of industries and increased the cost of defense products as well as all the things people buy. Each of these efforts reacts harmfully upon the employees as wage earners and as individual taxpayers.

This misguided tax is, to a large extent, responsible for the present low purchasing power of the dollar and the high cost of everything else.

Let us hope that the folks in Washington will see the light and permit this foolish and extravagant tax policy to die the quiet death it so richly deserves.

IT COULD BE LIKE THIS!

Harry Jones	
Earnings this year	$4,500
Normal Tax—20%	900
Take Home Pay	$3,600
With "Excess Profits" (wages) Tax:	
Hard Times Eearnings—1946	$0,000
1947	2,500
1948	2,700
1949	2,900
So-called "Normal" Income	$2,700
Base Figure Rate	83%
"Base" for computation of Excess Earnings	$2,240
Earnings—1951	$4,500
"Base"	$2,240
"Excess" Earnings	$2,260
"Excess" Earnings Tax Rate	62%
"Excess" Earnings Tax	$1,401
Normal Tax	900
Total Tax	$2,301
Earnings—1951	$4,500
Taxes	2,301
Take Home Pay	$2,199
Average "Normal" Income	2,700
IN THE HOLE	$ 501

A NEW IMPORTANT BOOKLET ABOUT FEDERAL INCOME TAXES

IT TELLS:

1. Their purpose, their use, how they have mushroomed in recent years.
2. If they are fairly apportioned, intelligently planned, or lopsided, unwieldy, unfair or wastely.
3. What their effects are on American industry and production.
4. If they permit growth of Small Business or threaten extinction.
5. How you are affected as an individual.
6. Whether the nation is taxing itself to destruction.
7. What remedies exist.

These, and many other vital and interesting facts, are clearly discussed in the bulletin, "Recommendations to Congressional Committee on Internal Revenue Taxation" by American Taxpayers Association, Munsey Building, Washington 4, D. C.

WRITE FOR IT — IT'S FREE

ing on this project at the present time.

Figure 6 shows tensile strengths and impact properties of two steel compositions which hold some promise at the high strength level. The first is the 8½% nickel steel with .40-.45 carbon. This steel is oil quenched from 1550°F. and double tempered at the range 350-500°F. This composition exhibits an excellent combination of tensile properties and notch impact toughness at the desired strength level of 260,000-295,000 psi.

Note that the second 8½% nickel steel analysis has additions of moderate amounts of chromium and molybdenum, although there appears to be little gained by their addition. As may be seen from the chart, this steel has a relatively low yield strength. There is a diversity of opinion as to whether a high yield or a low yield strength is desirable for this application. A low yield strength under conditions of successively greater overloads may be expected to plastically deform slightly each time, but this distortion would be quite small and unmeasurable except with precision instruments.

Strength-Weight Factor

It is noteworthy that, on the basis of tensile strength, these steels are lighter than aluminum alloys as a material of construction. At 250,000 psi, the strength-weight factor (obtained by dividing by the specific gravity, 7.8) would be 32.

Aluminum alloys (specific gravity 2.7) would require a strength of about 86,400 psi to be equally light.

In all high tensile steels, questions of thickness or mass, elimination of areas of concentrated stress and of minor defects must be given careful consideration in design.

A striking example of the application of alloy steels of very high strength is shown in Figure 7.

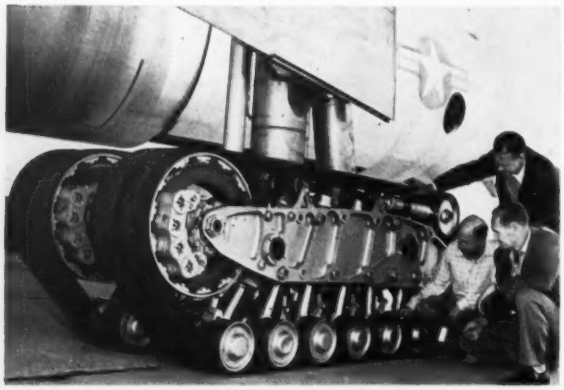


Fig. 7—Track-type landing gear for large bombers and cargo planes in which highly stressed components are made of "Hy-Tuf" steel, a high strength nickel-molybdenum steel developed by the Crucible Steel Company of America. Average composition contains 1.80% nickel, 0.40%

ports shrouded to the suction side of a high volume, low head, propellor. The volume of the oil bath in relation to the weight of the charge is another important consideration. When the quenching and heating factors are properly correlated, the use of oil baths at temperatures between 350-400°F. becomes practical without undue breakdown of the oil. From the production viewpoint, uniformity and controllability of the quench, influenced as they are by the loading factors, are essential for proper operation.

Surface conditions both of cleanliness and composition may be controlled by prepared atmospheres to the extent that the hot oil quench may be used on a large variety of steels and steel sections. Thus the prevention of scale increases the transfer rate while the limitation of the surface carbon to that of the eutectoid composition will allow a greater surface hardness after the quench. For some metallurgical requirements, the addition of nitrogen even in small amounts decreases the required quenching rate for transformation control and in addition increases the hardness; this treatment gives best results if the surface carbon concentration is carefully regulated. Quenching from a vestibule, sealed to both the heating chamber and the bath, allows atmosphere protection thruout the processing cycle. In addition, the vestibule may be employed to protect the work chamber itself from air infiltration, a precaution made necessary since the hot gases are much lighter than the air surrounding the unit. For control purposes, the use of purge gases at various portions of the cycle may be made in the vestibule proper without interfering with the supply to the high temperature chamber. Coupled with the provision of pressure control thru automatic relief valves the vestibule enhances the possibilities of metallurgical control. In connection with distortion control and hot oil quenching, it may again be emphasized that precise control of surface conditions is extremely important and that flexible aids to that end assist in making interrupted quenching feasible.

The division in the title, "Distortion Control and Hot Oil Quenching," has been made advisedly. Much can be done in distortion control by careful handling, loading, and quenching from the lowest possible temperature, although the quenching bath temperature be the normal one. However, when the acceptable limit is narrow with relation to the dimension itself it often happens that the interrupted quench presents the only feasible process. Such a part is the treated synchronizing ring, shown in Figure 1. Processed in batches of 640 each, a carbon-nitrogen case to the depth of 0.010 inches is produced at 1550°F. with the total heating and quenching cycle slightly under 2 hours. Figure 2 covers the complete heating and quenching equipment, with the bath heating control equipment in the foreground.

INCOLOY INCOLOY INCOLOY INCOLOY INCOLOY INCOLOY INCOLOY INCOLOY INCOLOY

Latest facts about INCOLOY

Newest member of the Inco family

Incoloy® was developed as a companion to Inconel®, long considered one of industry's most durable high temperature metals.

The latest test results now definitely establish the importance of Incoloy as a new high temperature material. (See tables.) In fact, its most useful mechanical properties are comparable to those of Inconel at temperatures up to 1800°F.

Both metals offer good resistance to oxidation. But Incoloy, having a lower nickel content, is likely to provide greater resistance to sulfur attack.

In structure, Incoloy is stably austenitic, and shows no tendency to become embrittled by precipitation of sigma or carbidic phases after prolonged exposure to intermediate temperatures.

Note also, in the tables, the important preliminary creep and rupture data which have been developed on Incoloy.

Like Inconel, the new alloy is readily workable, both hot and cold. Its rate of work hardening is practically the same as that of Inconel. And Incoloy can be welded by commonly-used methods.

All of the usual mill forms are produced — billets, rounds, flats, hexagons, sheet and strip, rods, tubing and wire. Consult your distributor of Inco Nickel Alloys for the latest information on availability from warehouse and mill. And remember — it usually helps to anticipate your requirements well in advance.

Remember, too, that you can always call on Inco's High Temperature Engineering Service for assistance in selecting the *right* metal for any high temperature application. All you need do is write and ask for a copy of the "High Temperature Worksheet." This is a simplified form especially designed to help you highlight the essential facts of your particular problem. The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

Incoloy
Preliminary Creep and Rupture Data
Condition: Course Grained-Annealed*

Creep

Temp. °F	Stress, psi, to Produce a Minimum Creep Rate of: .01% 1000 hrs.	.10% 1000 hrs.
1400	4400	5500
1600	2000	2900
1800	250	500
2000		200**

Rupture

Temp. °F	Stress, psi, to Produce Rupture in: 1000 hrs.	10,000 hrs.	100,000 hrs.
1400	8700	6000	(4200)
1600	3800	2200	(1300)
1800	1700	1100	(670)
2000	850	(540)	....

*2 hrs., 2050°F, AC
**.07%, 1000 hrs. (4000 hrs.)

INCO TRADE MARK

Inco Nickel Alloys

Incoloy... *for Heat-Resisting Applications*

News to Heat Treaters...

Special Casting Sealant Provides Unusual Chemical and Physical Properties

The importance of the chemical and physical properties of the sealants for ferrous and non-ferrous metals has just been spotlighted by recent research. After considerable experimentation, it has now definitely been established that the special sealant

Machined castings being removed after impregnation with Polyplastex "MC".

used in the exclusive process developed by the Polyplastex International Corporation, Inc., 441 Madison Avenue, New York, New York, presents, in addition to the physical properties required to insure the absolute elimination of microporosity, the chemical properties which render the impregnated casting impervious to the corrosive attack of non-inflammable hydraulic fluids. Such hydraulic fluids have become increasingly important in the design and operation of aircraft landing gears for example. Also of importance in some other applications, is the fact that the sealant has been found to provide a good base for a variety of coatings.

During the past year, proof that there has been considerable improvement in both the materials and methods applied in casting impregnation is found in the tonnage records of metals impregnated and is also emphasized by recent Ordnance Department approval of steel castings for mortar shells in addition to steel forgings. Such shell castings are, of course, impregnated to insure absolute density and solidity.

The Polyplastex impregnating process is licensed to manufacturers *or* special service industries such as heat treating plants, platers, anodizers and so forth.

New Domestic Production of Copper Cyanide

The likelihood of any more acute shortages of Copper Cyanide such as recently faced the finishing industry should be greatly diminished in the future, according to an announcement by Gerald G. Kraft, General Manager of the Kaynide Division of Kraft Chemical Co., Inc., Chicago. The announcement states that shipments of Copper Cyanide can now be regularly made from an entirely new source of domestic production.

The producing company is Copper Pigment & Chemical Corporation. Special control methods in their modern plant at East Newark, N. J., according to Mr. Kraft, enables them to produce free flowing Copper Cyanide of exceptionally uniform quality, whiter in color than has usually been supplied in the past.

The entire amount of this new production will be sold through Kaynide Division under its Kaynide label. Immediate shipments can be made not only from the East Newark plant, but also from ample stocks carried in Kaynide's Chicago warehouse. A distributor system is also being set up at key points around the country.

Portable Hardness Tester

The Peabody Instrument Company of 1819 Broadway, New York, N. Y., has a portable hardness tester available which, it claims, equals the accuracy to be found in standard bench model testers. The Peabody tester weighs only seven ounces and gives direct readings on the Rockwell B, C and 3000kg Brinell scales with the "S" model and on the Rockwell B and 500kg, 3000kg Brinell scales with the "NF" model.

The manufacturer states that the accuracy of the tester has been verified by an independent testing laboratory's report and the low price makes it possible to place a qualified hardness tester at the disposal of every metal working shop and in the hands of production workers. The tester may be obtained from the manufacturer on a two weeks trial basis.

First Nationwide Fork Truck Rental System Announced; Installment Selling Plan Also Introduced

The first national plan making possible rental of industrial trucks has been announced by John A. Baldinger, general manager of the Automatic Transportation Company, 149 West 87th Street, Chicago.

The plan will be carried out by the Chicago electric industrial truck manufacturer in conjunction with C. I. T. Corporation, the industrial financing subsidiary of C. I. T. Financing Corporation.

Automatic will negotiate agreements with potential users through its franchise representatives. C. I. T. then will purchase the equipment from Automatic and lease it to users. Rental contracts for all electric industrial trucks will be for nine years. Contracts for associated equipment, such as batteries and battery

chargers, will run from five to nine years.

Installment purchases of equipment are also made possible by the new program. The procedure in this instance resembles automobile financing. After an

initial down payment, regular monthly payments are arranged, not to exceed a 36-month term.

Baldinger said the plan undoubtedly will result in a substantial increase in sales of materials handling equipment. He added that the program puts Automatic's representatives in a position to sell a completely new group of prospects, those who have wanted to buy, but hitherto have been financially unable to.

The truck shown, manufactured in capacities up to 6000 lbs., is one of the many types available under the new plan.

New Electric Vapor Degreaser

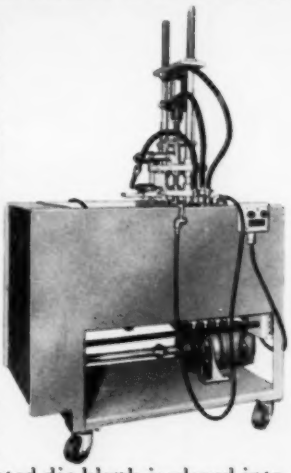
Selling for approximately one-half the price of comparable units, the Wallace DG-1 Degreaser provides many exclusive features not previously available in the vapor-degreasing field, according to J. D. Wallace & Company, 133 S. California Ave., Chicago 12, Ill.

Provided with either a 110 or 220 volt heating element, it is ready for instant plug-in operation. Heat-up time is less than 20 minutes, and requires only 2½ gals. of solvent. The manufacturer's non-inflammable Xsol solvent vaporizes at a higher moisture-dispelling temperature, and this coupled with a hot-dip galvanized steel tank practically eliminates rusting and corrosion problems common with water-cooled units.

The caster-mounted base and plug-in feature makes portable operation practical, permitting use of the unit at different work stations for greater efficiency, lower investment cost, and greater space-savings. The thermostatic control maintains a constant vapor level and prevents overheating; unique insulation provides for safety, efficiency, and comfortable use.

The manufacturer has provided for attachment of a flusher pump, lip-vent, 21" dia. work-baskets, and other accessories required on some degreasing applications.

New Machine Quenches Die Holes In Case Hardening



In announcing its new I. D. Hole Quencher, The Palmer Manufacturing Co. of Cleveland, O., claims that this machine puts into a scientific and automatic cycle of operations all those factors concerning temperature of the die, temperature of the coolant, timing of coolant exposure, etc., which heretofore has been a personal skill exercised by individual workers.

According to the manufacturer, the Palmer I. D. Hole Quencher is completely automatic. The heated die-blank is placed into position on the anvil; air operated rams contact above and below, holding a fitting tightly against die. When proper contact is made, brine or other solution is pumped thru die hole. When hole quenching is completed, depending on hardness required and area and depth of surface, a kick-out ram automatically pushes blank into tank for overall cooling. All timing, temperature and pumping operations can be set on a predetermined cycle and push button operated by any normally intelligent worker.

The manufacturer states that this unit is adjustable to handle from 1/16" to 3" I. D. holes in blanks 1/4" to 8" O. D. and from 1/16" to 6" long.

New Eastern Industrial Sales Agency

Claude A. Gates

Claude A. Gates, previously Vice President and Eastern Sales Division Manager for Wheelco Instruments Company, has formed his own industrial agency.

The new Claude A. Gates Company has established offices in New Rochelle, N. Y., and will represent manufacturers of industrial equipment in the areas of New York City, northern New Jersey, Long Island, Westchester and western Connecticut.

The new agency will render sales and application service in the field of industrial heating equipment and instrumentation.

The group of nationally known manufacturers represented by the Claude A. Gates Company includes, Claud S. Gordon Company, Ferguson Equipment Corporation, Waltz Furnace Company, Pyrometer Instrument Company, Clarke H. Joy Company, Waukee Engineering Company and others.

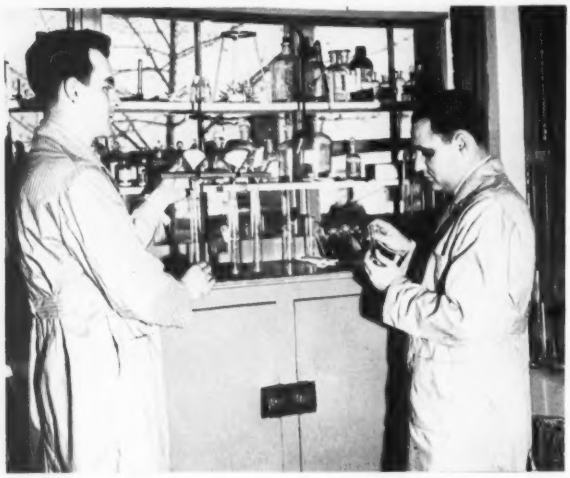
Mr. Claude A. Gates is a member of the New York chapter of the Instrument Society of America and has talked on various subjects to engineering groups.

(Continued on next page)

Acid-Resistant Laboratory Coats

The Cross Island Laboratories of Franklin Square, Long Island, N. Y., among the first users of Worklon laboratory coats made of 100% Dupont Orlon, report that they are rolling up remarkable records for long wear under conditions usually fatal to most fabrics. Two of the Cross Island chemists, shown here wearing these lab coats, point to almost two years of continuous wear of the same garments under rugged acid and chemical conditions. They also report that during this period the garments were *never pressed* . . . yet have always had a "just pressed" look. Before adopting these Orlon coats, the men had used up an average of eight cotton lab coats a year—destroyed and burned by acids and chemicals.

Chemists, laboratory and factory technicians, as well as those engaged in heat treating operations where working conditions make work clothes replacements frequent and costly, report substantial savings with the use of the new Orlon garments.



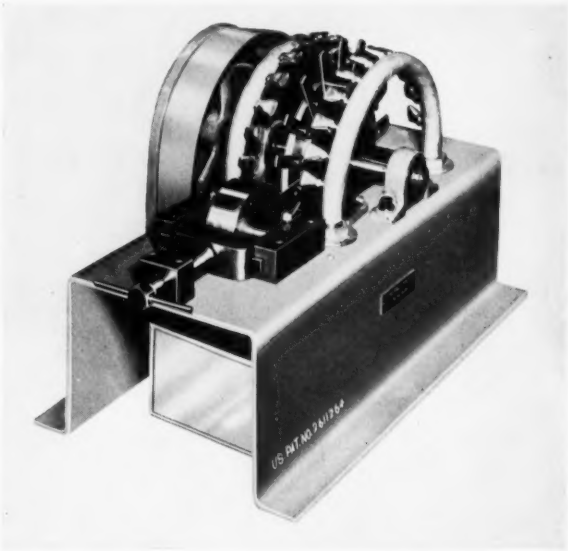
Worklon industrial work shirts, pants, coveralls and laboratory coats of Orlon resist severe acid and chemical conditions. They are also resistant to oil, grease, paint, dirt, deterioration by sunlight and ultra-violet rays, mildew, moths, and abrasion. They launder and dry quickly, need no ironing, and hold ironed-in creases through weeks of washing. They are lightweight and comfortable, and come in both standard and lint-free finishes. These coats are products of Worklon, Inc., 253 W. 28th St., N. Y., N. Y.

A New Tool for Determining the Resistance of Steels To Heat Checking

In recent years many notable advances have been made in the art of permanent mold and die casting, drop forging, hot piercing, extrusion, etc.; but the well-known die failure due to high temperature fatigue, also known as heat checking, still remains as a serious problem.

Similarly, many parts used at high temperatures, such as the parts of automotive and aircraft engines and other internal combustion engines, turbine blades, etc., fail under thermal stresses or heat checks.

The Thermo-Test determines the relative resistance of different materials to heat checking. Test pieces are successively heated, stressed and cooled. This cycle of heating, stressing and cooling is repeated until the specimen develops visible cracks or heat checks.



The number of cycles required to produce heat checks are indicated on a counter attached to the machine. As many as eighteen test pieces can be tested at one time. The effects of various heat treatments, the range of heating and cooling, amount of pressure applied to the specimen and the effects of various alloying elements on the resistance of steel to heat checking can be studied. Various materials used for molds, permanent molds, die casting dies, glass molding dies, drop forging dies, hot piercing mandrels, extrusion dies, hot rolls, etc., can be tested. The machine measures approximately 24" wide, 36" long and 18" high.

The Thermo-Test is being manufactured under U.S. Pat. No. 2611264 by Henry G. Keshian, Hotchkiss Grove, Branford, Conn.

New West Coast Lindberg Plant

Lindberg Engineering Company, Chicago, Illinois, recently opened its new West Coast Plant at 11937 South Regentview Ave., Downey, California.

This new factory comprises 12,000 sq.ft. of production and office space and will be used to manufacture industrial heat treating furnaces and other Lindberg products used in aircraft and other vital West Coast industries.

The new facilities were built to provide better servicing operations and to speed deliveries. It will also offer FOB Los Angeles prices on the complete line of Lindberg products.

You can treat it *Better* with HOUGHTON SALTS!

ADVANTAGES OF HOUGHTON LIQUID SALT BATHS:

- Provide fast, uniform heating of work.
- Eliminate scale and decarburization.
- Reduce cracking and distortion of irregular sizes and shapes of pieces.
- Doubly refined, assuring purity.
- Lower production costs . . . save cleaning time . . . require less expensive equipment.

• In Houghton's complete line of heat treating salts, you'll find the most advanced agents available for heat treating metals.

Aluminum parts, for example, are safely and efficiently treated with DRAW-TEMP 430. The salt meets requirements of MIL-S-10699, Class 2. It has a melting point of 430° F.—a working range of 550° to 1000° F. It treats aluminum in one-third less time than in atmosphere furnaces. And its thin film protects the metal enroute to the quench.

The 32-page booklet "Houghton's Liquid Salt Baths" will give you a host of practical, cost-saving ideas on heat treating. Ask the Houghton Man for a copy or write to E. F. Houghton & Co., Philadelphia 33, Pa.

. . . products of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

Most Effective and Efficient Way to

REMOVE HEAT TREAT SCALE AND DISCOLORATION WITHOUT DISTORTION

DIE SINKING HOB

Heat treat coloration uniformly removed in minutes. Produces a better finish for better work.

V-B

Liquid Honing*

SELF-CONTAINED UNIT, EASILY INSTALLED

Vapor Blast Liquid Honing is done in a self-contained cabinet. It is easily adaptable to automatic processing, with conveyors, turntables, and tumbling barrels. VB Machines are available in small tool-room models and larger, standard or custom-built to fit your requirements. Shown at right is Model 3030, Type B20, 30"x30" Liquid Honing Machine.

Heat treat scale and discoloration are removed by VB Liquid Honing without change in dimensions of precision parts — tolerances are held to .0001". One operator does the work of any six men using other methods. The superior finish obtained is ready for immediate use or for an outstanding job of plating, bonderizing, or other finishes.

By a large number of controllable variables, the Vapor Blast Liquid Honing process can be adjusted to the type of finish required. These variables include:

Kind, size and amount of abrasive;
Air pressure, air volume;
Time;
Gun distance and angle;
Kind, size and type of nozzle.

Write for information on VB manual and custom cabinets. Or send us one of your parts for a FREE processing demonstration.

V-B

*LIQUID HONING is a trademark
*VAPOR BLAST is a trademark

*VAPOR BLAST MFG. CO.

Dept. MT-4, 3025 W. ATKINSON AVE.,
MILWAUKEE 16, WISCONSIN

VAPOR BLAST MFG. CO. Dept. MT4
3025 W. Atkinson Ave., Milwaukee 16, Wisconsin

☐ Under separate cover we are sending a part for a VB Liquid Honing demonstration. We understand there is no obligation. Letter enclosed.

☐ Please send us complete details on Vapor Blast Liquid Honing.

Our product is.....
Firm.....
Address.....
City.....State.....
Attention of.....

WHAT'S YOUR PROBLEM?

ED. NOTE: Frequently "*Metal Treating*" is asked for answers to heat treating problems of various types. These are referred to technicians, metallurgists, etc. The correspondence below is typical.

Send *us* your problem—we'll try to get the answer and publish it for your benefit and others.

Dear Mr. Herington:

Thank you for sending me *Metal Treating*. Many articles will prove very helpful to me. Especially "Distortion of Tool Steels." I also straighten all warped tools besides hardening. High Speed Steel hardening is my job, which *sometimes* causes me a headache.

Perhaps you can help me out. My problem is Rex A. A. H. S. S. Dies, or any tool with a hole in the center. After hardening, quenched in oil to 1000°F. appr. cooled in air, the hole will be blistered. At first I would place the tool on a nicrome plate for placing in the high heat furnace. Eliminated that process. 2nd step was tool on bare hearth, next was asbestos on top and bottom. Nothing worked.

The tools in question are for use in the Hot Forge Dept. They have a habit of polishing their tools to a brilliant shine with emery or some compound. Rex A. A. is the only steel that will blister like this. The blister is like a sunburn blister without the water inside. Just the shell which is very hard and difficult to polish or grind out. Any help would be sincerely appreciated. *John Engratt*

Waterbury, Conn.

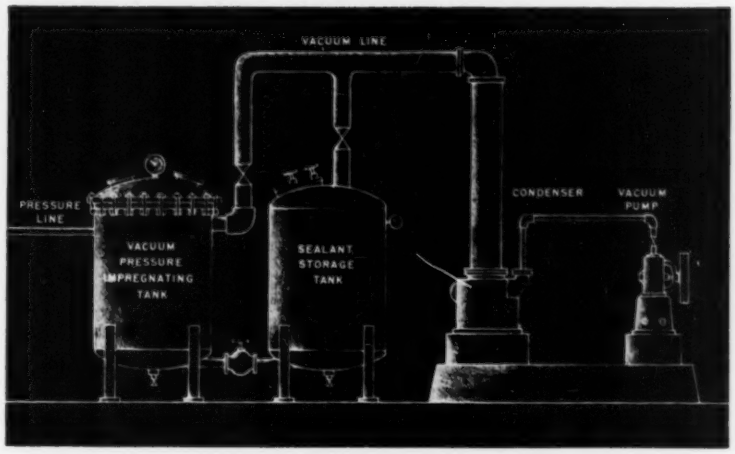
Dear Mr. Engratt:

Mr. C. E. Herington, Executive Secretary of the Metal Treating Institute, has forwarded your letter of January 26 to the writer for our consideration and recommendations. Although it is difficult to determine definitely the nature of your observations without actually seeing the condition, we wish to offer the following comments with regard to the blistered condition to which you refer:

There are two main types of surface reactions that result in high speed tools developing a blistered surface appearance during heat treating. One is due to decarburization in a strongly oxidizing atmosphere. However, the whole surface of the tool is apt to be affected. The other is due to a carburizing action. The carbon in the surface layer is increased to where melting of the surface actually takes place at the high temperatures used. Strongly carburizing conditions will affect the whole surface. Lighter carburizing conditions may affect only areas such as holes, where there is little or no circulation of the atmosphere. The latter evidently is what is being encountered in this case, since it was mentioned that it occurred in the hole and was very hard and difficult to polish or grind out. *D. I. Dilworth, Jr.*,

Assistant Director of Metallurgy
Crucible Steel Co. of America
Pittsburgh 22, Pa.

VACUUM-PRESSURE IMPREGNATION OF POROUS CASTINGS OFFERS PROFITABLE SIDELINE FOR METAL-TREATING PLANTS



Manufacturers are turning to impregnation of porous castings to improve casting quality.

Impregnation of porous castings assures pressure-tightness, extends service life and salvages rejects.

This is logical extra business for the commercial heat-treating plant when properly equipped for the work.

Complete Devine vacuum-pressure impregnating equipment can be installed in your plant at a surprisingly small capital outlay. It will be well worth your while to look into this new opportunity to expand your business. Write to us for more complete information.

J. P. DEVINE MFG. CO., Inc.

A. M. COX, President

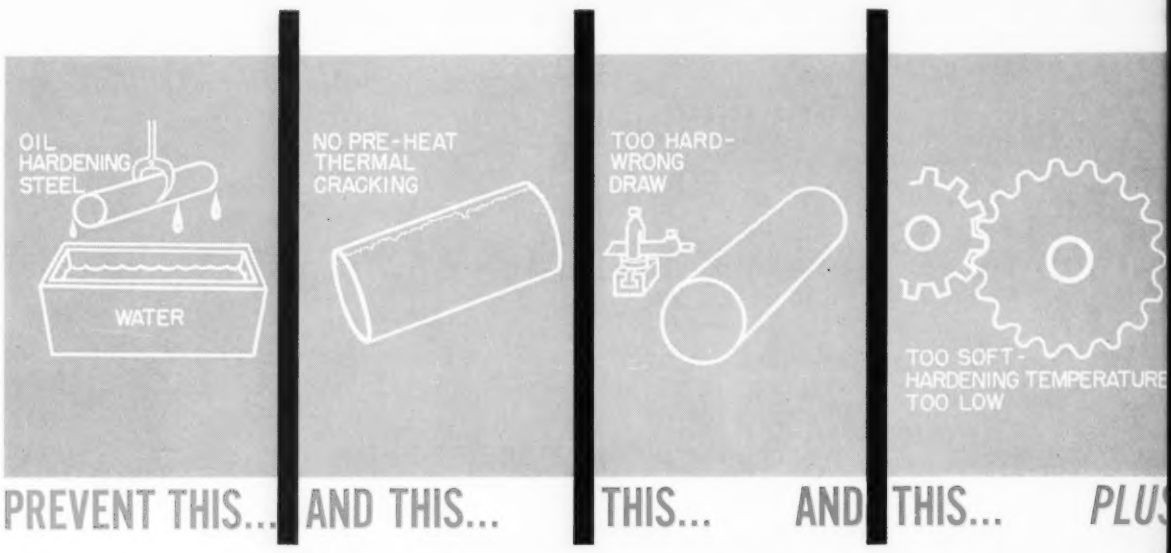
49th St. and AVRR **Pittsburgh 1, Pa.**

Devine

IMPREGNATORS

A SURE WAY TO

in HEAT T



One of the most common causes of error in heat treatment is failure to give the heat treater necessary data on the physical properties and chemical composition of the material to be treated.

When parts do not respond to treatment as expected, further corrective treatment is often necessary thus wasting valuable time and hard earned money for both the customer and the heat treater. Or in extreme cases the part is actually rendered useless and becomes scrap.

Acceptance and use of the new SAE designations given to commonly used steels to show their *heat treating characteristics and reactivity* will do a great deal to eliminate costly error and uncertainty.

Use of the identifying codes will save further time for the customer and the heat treater since the standardization of the SAE designations will make many other specifications presently used unnecessary.

Copies of the SAE number assigned to various materials in accordance with their heat treatability can be obtained from your local MTI member or from the Metal Treating Institute.

Get a copy now and you will easily see how their use will *help you*.

PREVENT ERRORS

REATMENT

There's a Heat Treating Specialist Near Your Plant!

CALIFORNIA

California-Doran Heat Treating Co.
2850 E. Washington Blvd., Los Angeles 23
Cook Heat Treating Corp.
5934 Alcoa Ave., Los Angeles 11
Hollywood Heat Treating Co.
1046 No. Orange Drive, Los Angeles 38
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Dexter Metal Treating Co.
1026—77th Ave., Oakland 21
Industrial Steel Treating Co.
1549—32nd St., Oakland 8

COLORADO

Metal Treating & Research Co.
4110 Fox St., Denver 16

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 5

ILLINOIS

Seneca Heat Treating Co.
70 S. Batavia Ave., Batavia
Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Chicago Steel Treating Co.
333 North California, Chicago
Dura-Hard Steel Treating Co.
2333 West Deming Place, Chicago 47
Lindberg Steel Treating Co.
222 North Laflin St., Chicago 7
Pearson Industrial Steel Treating
5757 Ogden Ave., Chicago 50
Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kenzie St., Chicago 22
American Steel Treating Co.
P. O. Box A, Crystal Lake
Eklund Metal Treating, Inc.
721 Beacon St., Love Park
O. T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford
C. U. Scott & Son, Inc.
1510 First Ave., Rock Island

INDIANA

Nerl Heat Treat Corp.
1824 So. Franklin St., South Bend 23

MARYLAND

Maryland Tool Company
111-13 Hollingsworth St., Baltimore 2

MASSACHUSETTS

New England Metallurgical Corp.
9 Alger St., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Acme Steel Treating Co.
119 Lieb St., Detroit 7
Anderson Steel Treating Co.
1337 Maple St., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Michigan Steel Processing Co.
3120 Denton, Detroit 11
Standard Steel Treating Co.
3468 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit

MINNESOTA

Metallurgical Control Labs.
2226 East Lake St., Minneapolis 7

MISSOURI

Metallurgical, Inc.
1915 Tracy Ave., Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Heat Treating Co.
611 Grove St., Elizabeth
American Metal Treatment Co.
Highway 25 and LaFayette St., Elizabeth
Benedict-Miller, Inc.
Marin Ave. and Orient Way, Lyndhurst
Bennett Steel Treating Co.
246 Raymond Boulevard, Newark 5
L-R Heat Treating Co.
107 Vesey St., Newark

NEW YORK

Fred Heinzelman & Sons
138 Spring St., New York 12
Alfred Heller Heat Treating Co.
391 Pearl St., New York 38
Metro Heat Treat Corp.
466 Broome St., New York 13
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Cincinnati Steel Treating Co.
Wooster Pike & Mariemont Ave., Cincinnati 27
Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 25
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1265-71 East 55th St., Cleveland 14
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 West Lake Road, Cleveland 16
Dayton Forge & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Limekiln Pike, Dresher
J. W. Rex Co.
834 West Third St., Lansdale
The Drever Company
220 West Cambria St., Philadelphia 33
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 East Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
4272 Wissahickon Ave., Philadelphia 32
Ferrotherm Company
4911 Butler St., Pittsburgh
Pittsburgh Commercial Heat Treating Co.
49th St. and A.V.R.R., Pittsburgh 1

TEXAS

Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11

WISCONSIN

Wesley Heat Treating Co.
825 South 21st St., Manitowoc
Hushek Metal Processing Co.
1536 West Pierce St., Milwaukee
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wesley Steel Treating Co.
1301-1403 West Pierce St., Milwaukee
Harris Metals Treating Co.
1745 Taylor Ave., Racine

Institute News . . .

MTI SPRING MEETING

The Annual Spring Meeting of the members of the Metal Treating Institute will be held at the Hotel Shamrock in Houston, Texas, May 18th, 19th and 20th. An outline of the program follows:

Monday, May 18th
9:00 A.M.—Special get-together Breakfast for all. (It is heard there will be a surprise program.)
10:30 A.M.-12:30 P.M.—Business Session
Technical Speaker—"New Heat Treating Methods for Alloyed Materials"—Howard Scott (tentative), Manager of Metal Research Division, Westinghouse Electric and Manufacturing Company.
12:30-1:30 P.M.—Group Luncheon
2:00 P.M.—Bus from Hotel to outlying spot for Outdoor Barbecue
Tuesday, May 19th
9:30 A.M.-12:30 P.M.—Business Session
Technical Speaker (tentative)—Official of the Hughes Tool Company—Subject to be announced
12:30-1:30 P.M.—Group Luncheon
3:00 P.M.—Bus to San Jacinto Battleground for tour
6:00 P.M.—Special Dinner at San Jacinto Inn
Wednesday, May 20th
9:30 A.M.-12:30 P.M.—Business Session
12:30-1:30 P.M.—Group Luncheon
2:00-3:30 P.M.—Bus to Hughes Tool Company, one of the largest heat treating departments in the country.
4:00-5:30 P.M.—Tour Cook Heat Treating Co .of Texas
7:00 P.M.—Reception and Banquet—Entertainment and Orchestra

MTI Spring Meetings are designed to be well-balanced combinations of serious and helpful business and technical sessions together with taking maximum advantage of the opportunities afforded by the convention locale for fun and relaxation. Houston, Texas, was selected with these thoughts in mind as the "South's Largest City" and the Shamrock, of course, is one of the nation's show places as a hotel.

From the standpoint of excellent and luxurious facilities combined with an interesting location, the Shamrock and Houston should prove ideal. From a weather standpoint, as one report points out, "Houston has lots of weather but most of it is good." Daily annual temperature average is 70°.

COMMITTEE APPOINTMENTS

President A. M. Cox recently appointed a By-Laws Revision Committee consisting of the following:

C. M. Cook, Cook Heat Treating Co. of Texas, Houston, Texas
L. G. Field, Greenman Steel Treating Co., Worcester, Massachusetts
C. R. Weir, Commonwealth Industries, Inc., Detroit, Michigan
A. Eklund, Eklund Metal Treating, Inc., Love Park, Illinois
R. G. Sault, Porter Forge & Furnace, Inc., *Chairman*, Somerville, Massachusetts
Arlo Leidig, Hollywood Heat Treating Co., Los Angeles, California
C. H. Muehlemeyer, O. T. Muehlemeyer Heat Treating Co., Rockford, Illinois
Fred Heinzelman, Sr., Fred Heinzelman & Sons, New York, New York
J. W. Rex, J. W. Rex Company, Lansdale, Pennsylvania

Each member of this committee has received a copy of the By-Laws with the request that a study be made and he submit suggestions for their modernization and increased effectiveness. *(Continued on page 28)*

Shamrock Hotel, Houston, where the members will gather May 18th, 19th and 20th.

New Development in Salt Baths

Eliminates scale and decarburization on steels in neutral salt baths operating up to 2300° F.

NEUTRAL hardening in molten salt baths should mean just what it says. No scale or decarburization is present in a properly rectified neutral salt, regardless of temperatures used. This is possible at 1500°F. and up to 2300°F. A recent development by one of the leading salt bath suppliers makes this possible for the first time without the manual addition of solid deoxidizers. The Neutra-Gas Process (U. S. Patent No. 2474680) is simple, effective, and inexpensive. Merely bubble an inexpensive commercial gas through the molten bath for recommended periods. Neutrality is easily checked chemically or physically. The Neutra-Gas Process is operating at the present time in molten baths weighing less than 100 pounds and those holding several tons of salt.

A truly neutral salt is the ideal medium for heating all steels with no surface effect. There is no atmosphere, and air is excluded while the work is heating. Scaling and decarburization are prevented. A thin film of salt protects parts right up to the quench. With neutral salts operating at 1500°-1600°F., Neutra-Gas is used for just a few minutes per shift. Sludging is practically eliminated; economies result because sludging removes good usable salt. The bath remains very fluid allowing rapid and uniform heating with less distortion. To obtain all the advantages of salt bath hardening, use salt baths for both heating and quenching The improved fluidity of the Neutra-Gas controlled neutral salt assists materially in isothermal quenching salt operations.

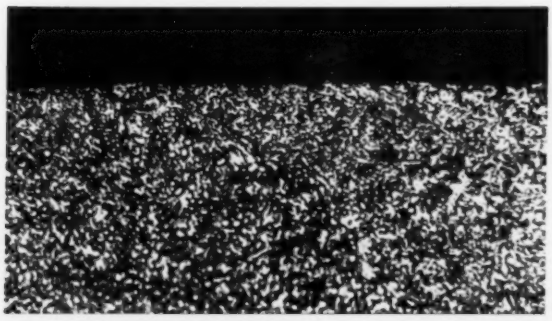
Neutral Salts from 850° — 1850°

Various salt mixtures provide a wide range of usefulness in the heat treatment of steel. The Neutra-Gas is used with chloride mixtures only. The most popular type is Park Nu-Sal Neutral Salt. Its melting point is 1230°F. with a range of 1300°-1600°F. Most steel hardening temperatures fall within this range. Nu-Sal is widely used as the austenizing bath for isothermal treatments such as austempering and martempering.

Cycle annealing involves a wider range of temperatures. Park K-3 Neutral Salt melts at 1020°F. and is usable past 1700°; periodic use up to 1850° is permitted if proper rectification is made with Neutra-Gas.

Low melting salts are available for special purposes. Park's #800 Neutral Salt (melting point 850°F.) and Park #900 Salt (melting point 920°) are used for tempering, high speed steel quenching, and have a range up to 1700°F.

Baths operating consistently at 1700° to 1900°F. usually operate with less fuming and volatilization if their melting points and top operating temperatures are slightly higher. Park K-17, with a range up to 1900°F., also has a reasonably low melting point of 1175°F. Economy is indicated here as the temperature of an idle furnace may be kept at 1250°-1300° with very low power costs.

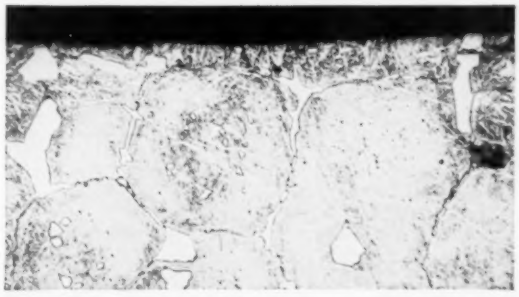


(X 500) Microphotograph of the edge structure on SAE 1095 steel treated for 60 minutes at 1450°F. in a commercial installation of Park Nu-Sal kept neutral with the Neutra-Gas process. (Sample quenched in caustic solution and tempered in No. 800 Neutral Salt at 1200°F.)

No Decarb on Moly High Speed Steels

Wider use of molybdenum high speed tool steels has virtually made the use of salt baths mandatory. During the last War it was salt baths which made possible the adoption of the molybdenum high speed steels in place of the very critical tungsten types.

As in most instances, the increased use of a method leads to rapid improvements. The improved rectification of high heat salt baths operating from 2200°-2300°F. is a development of the Park Chemical Company laboratories. The Neutra-Gas Process was adapted to the higher temperature applications in order to reduce the oxides of the chloride salts. Metallic oxides are reduced by graphite rods immersed in the salt. Costly and laborious sludging has been nearly eliminated and electrode life increased. Size loss of tools is held to a minimum. It is possible to harden unground or finished tools. Scaling, decarb, oxidation, pitting and other surface defects are automatically avoided. Distortion is negligible. Immersion in salt seals out all atmosphere. Salt film protects work right through the quench. For pieces large or small, temperature is even and constant.

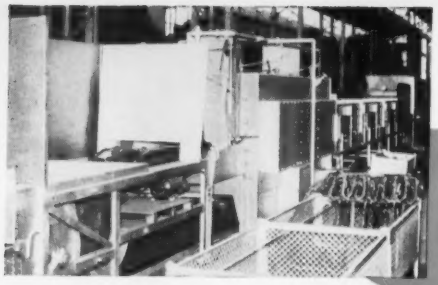


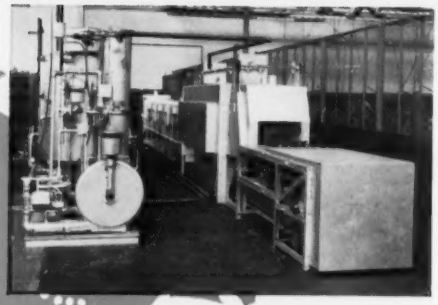
X500—(Reduced in Printing) Edge structure of high speed steel after several hours in a Park No. 175 Hi-Heat salt bath.

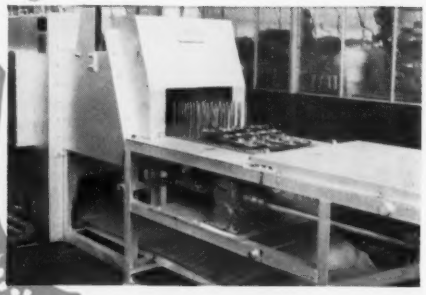
Process detail is preheat at 1550°F. in Park No. 117 Preheat Salt, high heat at 2200°-2350°F. in Park High Heat No. 175-S with Neutra-Gas. Quench in either No. 900 Neutral Salt, or in No. 100 Quench Salt which contains a small amount of cyanide. Tempering in salt completes the cycle, free from any deleterious effect caused by contact with the atmosphere.

Park's salt baths, and the knowledge of how to make them do a better job for you, can effect economies in your heat treat department. Write, telling us in detail your application, and we will send you the technical bulletin that covers your particular operation. There is a Park field engineer to assist you, backed by a technical staff and 40 years of Park Chemical Co. service to the heat treating industry. Park Chemical Company, 8076 Military Ave., Detroit 4, Michigan.

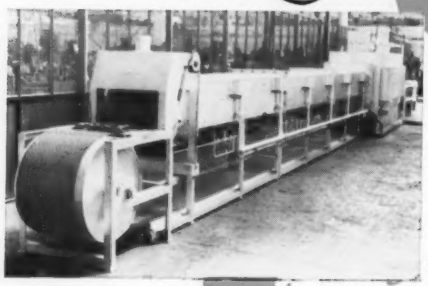
Write today for new 4-page bulletin on "Neutral Salt Baths and their operation" (Bulletin H-1)







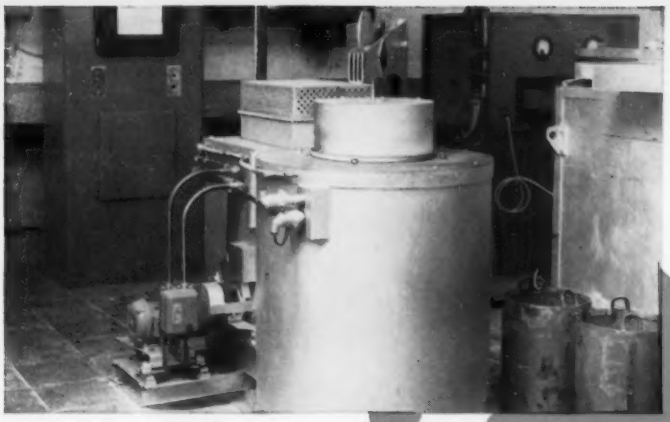
LINDBERG IN Italy



At the famous Fiat automobile factory in Turin and at the Innocenti plant in Milan, Lindberg conveyor production brazing furnaces are being used for low temperature silver brazing . . high temperature copper brazing . . sintering of powdered metals . . and bright annealing. For details and "case history" information contact your nearest Lindberg representative.

LINDBERG FURNACES

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street, Chicago 12, Illinois



LINDBERG IN *France*

La Compagnie Singer in Paris is but one of the many manufacturers throughout the world who use Lindberg heat treating furnaces. At the Singer plant, high speed tools are hardened in Lindberg "Hydryzing" furnaces*. And tempering is handled in Lindberg "Cyclone" tempering furnaces*.. utilizing the famous forced convection heating principle.

For details and "case history" information contact your nearest Lindberg representative.

*Built under license by Etablissements Jean Aube, Paris, France.

LINDBERG FURNACES

LINDBERG ENGINEERING COMPANY

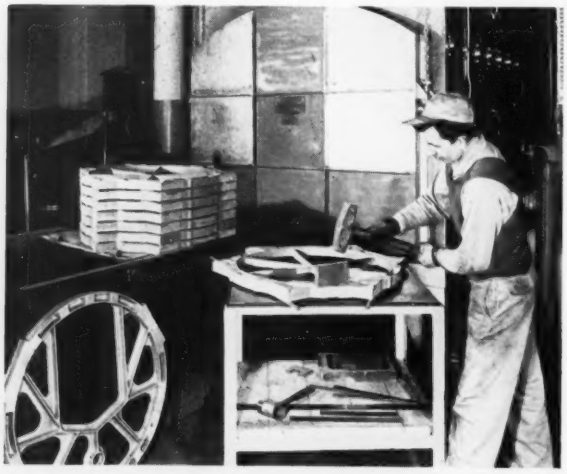
2466 West Hubbard Street, Chicago 12, Illinois

HEAT TREATING HINTS

Straightening Aluminum Sand Cast Alloys

The straightening of solution treated and precipitation hardened aluminum sand cast alloys has always been an expensive procedure. The small bulky castings are not as prone to warp during the quench as the large irregular shaped parts. It has been the practice to straighten by hammering them into tolerance with a rubber or wooden mallet on a heavy steel plate. The castings are most ductile directly after the solution treatment. It takes considerable skill to wield the mallet effectively, and on large castings a great deal of energy is expended.

Small or light sectioned castings can best be straightened with a wooden or rubber mallet as shown here. This method requires considerable skill.



For larger, heavier castings, the use of steel blocks and a sledge is more effective. This does a better, faster job and requires less skill.

Instead of striking directly with the heavy mallet, it has been found expedient to place soft steel blocks of suitable sizes and shapes in the desired areas and striking these with a ten to sixteen pound steel sledge. This does a better, easier and faster job. Less skill in hammering is required and straightening time can be materially reduced.

The blocks should have a large enough face area so that they do not dent the casting.

F. Heinzelman, Sr.
Fred Heinzelman & Sons
New York, New York

Lithium Vaporizers Cut Cost of Cleaning Crankshafts After Annealing

At the Ford Motor Co. of Canada, Ltd., it was management's object to lower the over-all production cost of cycle annealing and cleaning cast crankshafts. Their first practice had been to completely clean the castings of foundry sand before sending them through the furnace and cleaning them again following the normalizing operation to remove the scale formed in the furnace. They then tried another procedure, believing it preferable to do all the cleaning after normalizing. However, the scale already on the work as it came from the foundry sand together with the additional scale formed in heating, produced a surface which required a rather prolonged table blast operation of from 12 to 15 passes.

Without changing the existing furnace design or construction, two standard Lithium Vaporizers were attached to each side of the direct fired furnace. These are simple accessories that can be fitted to any furnace. They are small refractory lined chambers which are gas fired. Running through the middle of the chamber is a rectangular refractory tube in which rests a boat of Lithium compound. When the chamber is heated, the compound is vaporized and the Lithium vapor is picked up by the products of combustion which enter the tube and carried into the furnace. Here the Lithium vapor, as it mixes with the products of combustion resulting from direct gas firing of the furnace, provides a high degree of atmosphere control, maintained with a minimum of adjustment. The Lithium not only inhibits additional oxide formation on the castings but also tends to change the character of the scale which was on the metal when it was put in the furnace, making it relatively soft, thin and flaky.

Thus, with the annealing completed, the castings are in a much better condition for cleaning. The operation now requires only 5 to 8 passes for cleaning the same equipment. This means a 50% reduction in cleaning time and cost.

It has also been discovered that the Lithium Atmosphere, permeating the furnace chamber to form a coating on the crankshafts, also covers the alloy parts, such as furnace rails, trays and other fixtures which are in the furnace or pass repeatedly through the furnace. This coating inhibits normal oxide attack, increasing furnace alloy life at least 50%.

(Continued on next page)

Heat Treating Hints (cont.)

Straightening By Grit Blasting

Commercial heat treaters often have to harden special tools and parts of such a nature that warping during the heat treating operation cannot be held within the tolerance specified, particularly when high Rockwell hardness is required. This is especially true of long, thin reamers, broaches, bars, shafts, arbors, blades, strippers, wear plates, etc.

It is not an unusual request that such parts—varying in length from 8"-24", often less than $\frac{3}{8}$" diameter or $\frac{3}{16}$" thick—be held within less than .008" grinding tolerance.

Martempering and clamping in fixtures during tempering will in some cases be successful. Too often, however, the parts are not sufficiently within limits and the part is peened with hammers to within specification. This practice is questionable because subsequent grinding, or even aging at room temperature, may release the compressive stresses that were caused by peening and cause deformation again.

Grit blasting the low spot may be just as effective in straightening as peening, and subsequent grinding will not cause the part to spring back to its original distortion. This is a result of the uniform stresses set up by grit blasting throughout the piece instead of the concentrated, non-uniform stresses caused by hammer peening.

WILLIAM HEINZELMAN
Fred Heinzelman & Sons
New York, New York

Specified...Accepted
wheelco Instrumentality

CAPACITROL WITH CAPACILINE

for control of temperatures and other process variables

SIMPLE • • ECONOMICAL • • ACCURATE

Designed to satisfy the need for close limit temperature control, Wheelco Capacitrol with built-in Capaciline provides a low-cost equivalent of proportioning control. Speeds production . . . reduces waste in fuel and materials . . . assures maximum uniformity of product.

The Capaciline is designed for use with any Wheelco Capacitrol or other two-position pyrometer controller.

PANELMOUNT DESIGN SAVES SPACE

For mounting a number of controllers on a given installation the Panelmount controller is most compact for panel mounting. Dimensions of the case permit flush mounting of a number of control units or recorders on the same panel. Front dimensions are only 6-3/4 inches high and 19-1/16 inches wide.

Unit construction . . . featuring easily removed plug-in units on each side of the indicator mechanism . . . simplifies servicing and maintenance.

Nationwide Engineering and Sales Offices

WRITE TODAY FOR
BULLETINS 292-1 AND PC-1

BARBER COLMAN

wheelco instruments division
BARBER-COLMAN COMPANY
1266 ROCK STREET • ROCKFORD, ILLINOIS, U.S.A.

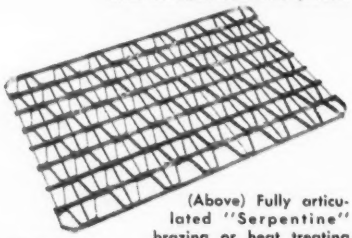
ROLOCK

FABRICATED HEAT AND CORROSION RESISTANT ALLOYS

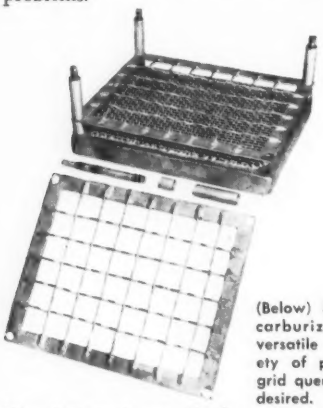
WHY FABRICATED?

All Rolock heat treating equipment is fabricated... not cast. Every carrier is job-engineered for the specific use and made from the correct metals and alloys for maximum resistance to all conditions of exposure, shock and abrasion. Especially successful are Rolock applications of nickel alloys . . . replacing heavy castings with durable, lighter weight fabrications. The examples shown below, while custom-built, can be adapted to your needs. We welcome your requests to solve your heat treating equipment problems.

(Above) Stainless drop-bottom pit furnace basket for quality, uniform heat treat. Saves seconds between heat and quench.



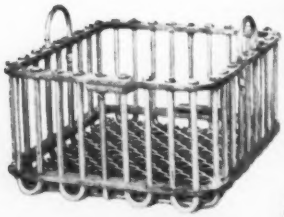
(Above) Fully articulated "Serpentine" brazing or heat treating tray, retains shape. Heavy or light, any width, length, depth. Many uses at lowest hourly cost.



(Below) Sectional lift post carburizing fixture. Most versatile for handling variety of parts. Each loaded grid quenched separately, if desired.

(Above) Rugged assembly for carburizing shafts in pusher furnace. Adjustable posts position fabricated alloy screens; mesh to suit work. Light weight, high pay load, long life.

(Right) Inconel basket assembly for nitriding. Only required baskets need be used for less than capacity operation . . . reducing furnace load.



(Above) Alloy carburizing basket. Loose joints expand under heat. Rugged, flexible construction resists abuse.

Offices in: PHILADELPHIA • CLEVELAND • DETROIT • HOUSTON • CHICAGO • ST. LOUIS • LOS ANGELES • MINNEAPOLIS • PITTSBURGH

ROLOCK INC. • 1232 KINGS HIGHWAY, FAIRFIELD, CONN.

JOB-ENGINEERED for better work
Easier Operation, Lower Cost

3RL838

Heat Treating Abstracts

How to Heat Treat Aluminum

The versatility of aluminum is enhanced by the fact that the material can be obtained with a wide range of tempers of physical characteristics. Some of the variations are brought about through cold working, some by heat treatment and others by a combination of both methods. Heat treatments include annealing, solution heat treating and aging.

Annealing is used both to soften the metal for further working or to remove residual stresses which result from fabrication. Tempering is done at temperatures ranging from 650° to 800°F. depending upon the alloy. Temperatures are not highly critical, but the combination of time and temperature is with most alloys. In annealing castings to remove stresses, the parts are held at temperature for several hours.

High strength aluminum alloys are given solution heat treatments to achieve maximum properties. The material is heated to a point just below the melting point of the alloy and held sufficiently long to allow the alloying elements to go into solid solution. Following solution treatment the aluminum is quenched as rapidly as possible to assure the elements being held in solution.

After quenching, solution treated alloys are in an unstable condition so they must be aged. In some alloys aging is comparatively fast while in others the action continues for months. Aging can be speeded in most alloys by holding the alloy at temperatures of from 240° to 380°F. until precipitation of the alloying elements is completed. On the other hand if it is desired that aging be retarded, the alloys can be held at low temperatures.

The most critical element in solution heat treating aluminum alloys is the interval between removal from the furnace and immersion in the quench. For some alloys this interval must be less than 10 seconds to achieve maximum properties.

(Abstracted from "How to Heat Treat Aluminum," Floyd A. Lewis, *Materials & Methods*, September, 1952.)

Saving Alloys by Heat Treating Carbon Steel

API casing in Grade N-80 for deep oil wells is normally made of normalized and drawn high manganese-molybdenum steel. However,

(Continued on page 33)

tool steel is the cornerstone of our business

Just as the cornerstone is of fundamental importance to a building, tool steel is the base of our business. And ever since we were founded — now over 50 years ago — we have been proud of our reputation as the nation's leading producer of tool steels.

We have always given our customers what they needed — quality and service — regardless of their volume of business or the general supply and demand situation. During last year's steel shortage, for instance, all our customers had their share of our production.

You too, can benefit from our long experience in this field through our freely available metallurgical service . . . and from our reliable delivery service through our fully stocked warehouses, conveniently located all over the country.

SEND TODAY for the unique Crucible Tool Steel Selector — a twist of the dial gives the tool steel for your application.

Rex® High Speed Steels
Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
Sanderson Carbon Tool Steels
Ketos®
AirKool Die Steel
Airdi® 150
Nu-Die V Die Casting Steel
CSM 2 Mold Steel
La Belle® Silicon #2
Atha Pneu

SPECIFY YOUR TOOL STEELS BY THESE BRAND NAMES

Crucible Steel Company of America
Dept. MT, Chrysler Building, New York 17, N. Y.

Name_____

Company_____ Title_____

Address_____ City_____ State_____

9" diameter, 3-colors

CRUCIBLE first name in special purpose steels

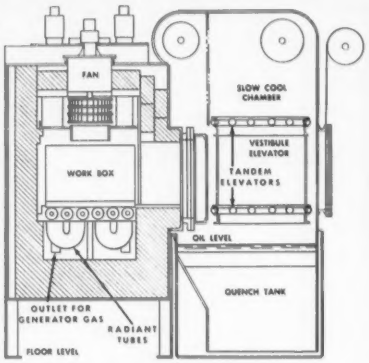
53 years of Fine steelmaking

TOOL STEELS

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

DOW

FIRST with MECHANIZED BATCH — TYPE CONTROLLED ATMOSPHERE FURNACES



MODEL "J"

The Dow Model "J" is a small mechanized furnace for production carbonitriding, gas carburizing, clean hardening, carbon restoration and bright annealing. It is the ideal furnace for small heat treaters and manufacturers where flexibility is required. Size: 7'10" wide, 14'4" long—head room 15'. Production capacity: 250-350 lbs. per hour on light case work.

NOW GIVES YOU A SMALL FURNACE WITH THESE OUTSTANDING FEATURES—

1. Tandem Elevator construction permits reloading furnace while load is in oil quench or slow cool chamber.

2. Fan (5000 cfm) removable from outside and heat capacitors provide positive directional flow of atmosphere.

3. 4 Vertically mounted Radiant tubes with 600,000 BTU per hour input with built-in generator.

DOW FURNACE COMPANY

OPTIONAL FEATURES

Hot Oil Quench system—provides exceptional distortion control. Large gas fired immersion tubes supply heat at low intensity thus minimizing oil breakdown.

Slow Cool Chamber permits cooling of a full furnace load in atmosphere and reloading without loss of time.

Delivery 8 to 10 weeks depending upon orders on hand.

DOW FURNACE COMPANY

12045 WOODBINE • DETROIT 28, MICH.

Institute News (cont.)

PLANT VISITS

On a recent trip to Cleveland, Lee P. Josephs, President, and Vic Bozick, Works Manager of Pearson Industrial Steel Treating Company, visited Lakeside Steel Improvement Company and the George H. Porter Steel Treating Co. We understand that Mr. Josephs and Mr. Bozick felt the visits to be very worthwhile. With the growing membership of the Institute it is not at all difficult to fit in visits to member plants on almost any trip and they pay off in new friends, ideas, and suggestions.

Rudolph J. Thurner

Rudolph J. Thurner, 74, of 2662 N. Grant Blvd., Founder and President of the Thurner Heat Treating Co., 809 West National Ave., Milwaukee, Wisc., died at Milwaukee Hospital March 1st, after a years' illness.

Mr. Thurner was instrumental in developing various heat treatments for metals which were especially valuable in the manufacture of lighter weight machinery without sacrifice of strength. He formed his own company, Thurner Heat Treating Co., in 1914.

He was a long time member of the Metal Treating Institute and a sustaining member of the American Society of Mechanical Engineers.

J. H. Schriml

John H. Schriml, president of the Ohio Heat Treating Co., 1100 E. Third St., Dayton, O., died March 2nd, after a six months' illness.

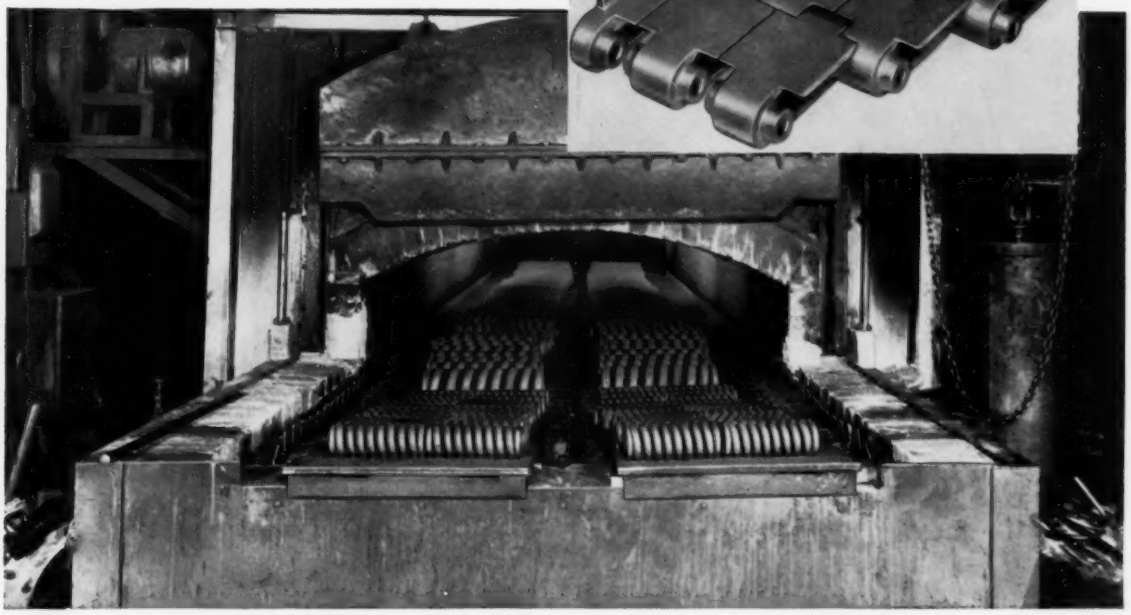
Mr. Schriml was one of the founders in 1919 of the heat treating firm, along with the late Theodore Hollenkamp and Harry Turner. He had been President of the firm since its incorporation in 1927.

A lifelong Dayton resident, he was a member of the Metal Treating Institute, the Fraternal Order of Eagles, the Knights of St. John, Novelty Club and St. Joseph's Orphans Society.

NEW CONVEYOR DESIGN

offers extra heat-treat advantages . . .

- *extra* strength
- *extra* loading capacity
- *extra* long service



This new conveyor belt† was designed to carry loads not possible with conventional style belts. It does not replace conventional cast belts, but serves to widen the field to applications involving extreme temperature and loading conditions formerly unattainable with ordinary belts.

The new Thermalloy staggered-link, conveyor design shown above offers you these features:

1. Elimination of crank-shafting.
2. A free-floating link which can adjust itself to meet localized stresses.
3. The substitution of strong, wear-resistant, cast-in pins for the weaker wrought pins.

For complete information on this new Thermalloy conveyor belt, standard belts or other furnace parts, contact your nearest Electro-Alloys representative. Or write Electro-Alloys Division, 4003 Taylor Street, Elyria, Ohio.

*Reg. U.S. Pat Off. †Pat. Applied For

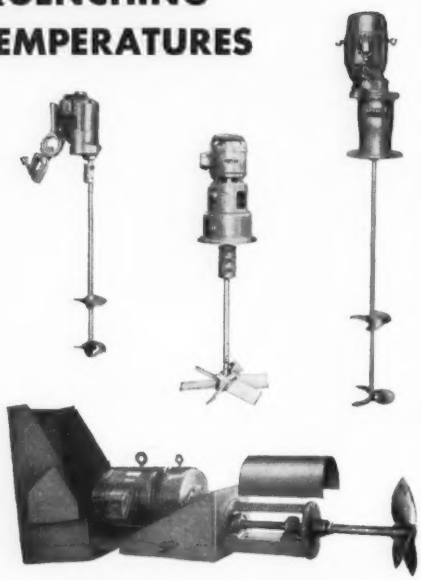
AMERICAN Brake Shoe COMPANY

ELECTRO-ALLOYS DIVISION
ELYRIA, OHIO

DEVINE AGITATORS

ASSURE

UNIFORM QUENCHING TEMPERATURES



- Provide proper circulation of quenching liquid.
- Help equalize quenching strains.
- Compact. Self-contained. No piping required.
- Unusually sturdy. Built for plenty of use.
- Easy to install. Easy to detach. Easy to maintain.

Devine Engineers will be glad to recommend a type and size to fit your tank.

J. P. DEVINE MFG. CO.

A. M. Cox, President

49th St. and AVRR · Pittsburgh 1, Pa.

Devine AGITATORS

Cleaning Precision Parts On A Jobbing Basis (cont.)

An 80% total saving on one job was experienced by a manufacturer of metal-cutting dies. Surfacing time on a set of 17 die inserts was reduced 5 hours, and 10 hours were saved on punch inserts over former paper polishing and stoning methods.

A candy concern had a cleaning problem where wet blasting assisted considerably. The problem involved scale removal and recessed letters on embossing punches. Ordinarily, stick polishing in the letters would have been a long and tedious job, with the possibility of a certain amount of distortion on the sharp edges on the work. Wet blasting in the treating shop removed every vestige of scale, and no further surfacing was needed on the letters before the punches were used.

Gears are another frequent application. Wet blasting for scale removal leaves a matte-finish on them which materially improves their appearance over ordinary scale removal methods. In addition, the matte surface holds lubricants well, and makes a better performing gear, with less friction.

Other jobbing applications also present themselves. One heat treater uses his machine to provide micro finishes for customers. After rough machining, work is heat treated. Grinding at the customer's plant reduces the parts to an 8 to 12 micro finish, and subsequent wet blasting at the treating shop reduces them to the required number 4 finish.

Many heat treating shops have applied wet blasting to expensive dies and molds before they are heat treated to show up any imperfections or cracks in the work. Naturally, after polishing papers have been used to bring the part to dimensional limits, there is some finely powdered material on the surface which might disguise surface defects. The surface can be completely cleaned of this material by wet blasting.

Wet blasting after heat treating serves as a check on the hardening operation. Soft spots in non-uniformly hardened steel show up as a darker shade of gray than do the hard areas.

Concentration on Design

Since wet blasting has been in use for several years, the more recent improvements have been in phases other than in the process itself. The elimination of certain maintenance problems has been given much attention. One development of this work has been the trend toward using inverted V-shaped tracks for the work car, causing abrasive to wash off rather than pile up, and the car becomes more free-acting. Gauntlets have undergone redesign to make them drip-proof. Hopper drainage has been made easier and more thorough. Fluorescent lights have been used so that abrasive would not bake on the light wells to impair vision. Platforms for the operator to stand on have been made unnecessary with some machines, and "push button" starting and stopping has been developed to save much waste time in the machine's operation.

15 TYPES
INDUSTRIAL POT FURNACES . . .
GAS - OIL - ELECTRIC.
SALT BATH CONVEYORS.

HOLDEN
METALLURGICAL
PRODUCTS

TRADE MARK REGISTERED

50 SALT BATH
COMPOSITIONS FOR ANY
HEAT TREATING APPLICATION.
BLACKING BATH.

ADDITIVES—VERSUS—RECTIFIERS

The benefits of the new combinations of salt baths containing additives can be summarized briefly as follows:

1. **The additives do not create sludges, but rather act to neutralize alkalies.**

2. **Further, the additives react with metal oxides which cause decarburization and sludge to decompose these oxides either partially to gases, or to complete reaction which is approximately the same specific weight as the salt compound. This therefore eliminates sludges, except for contamination from fixtures.**

3. **Additives in the high temperature baths, when used for hardening high speed steels, whether with inconel or chrome electrodes, keep the electrodes clean, preventing attack at the grain boundaries and further convert the chrome oxides to pure metallic chrome.**

4. **The use of these additives, therefore, plays an important part in maintaining the fluidity of your salt bath and lengthening the life of the electrodes. Also, these salt baths which have additives in them, when used in alloy pots, react with alkalies and metal oxides, nullify the effects at the grain boundaries of the alloy pots.**

5. **These products—Hardening 185-10, Hardening 127-11, Hardening 127-12, Hard Brite AA-10, High Speed Preheat 13-17-10 and High Speed 17-24 AA-10—will increase electrode life, ceramic and alloy pot life.**

6. **Holden Salt Baths can be used in any type of competitive furnace. We will assume manufacturer's guarantee with any proven design.**

WRITE FOR DETAILS!!

If you are having trouble with sludging, short electrode life, short alloy pot life, your initial order for Holden Salt Baths should clearly demonstrate the improvements which can be effected in your operating department.

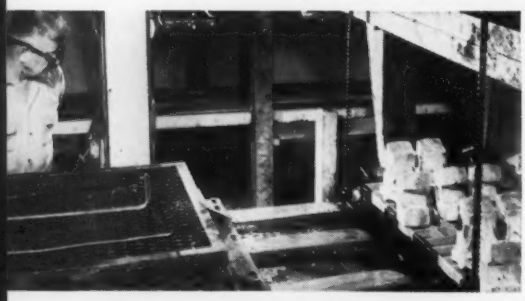
THE A. F. HOLDEN COMPANY

P.O. Box 1898
New Haven 8, Conn.

11300 Schaefer Highway
Detroit 27, Michigan

Picture shows how oil that forms sludge can clog cooler. Sun Quenching Oil's natural detergency helps prevent such sludge formation.

Oil Coolers Don't Clog with



A New England firm uses five 2400-3000 gallon systems to quench all types and sizes of aircraft and automotive forgings. Since Sun oil was adopted 7 years ago, not one system has required cleaning except for normal removal of mill scale.

Sun Quenching Oils keep oil coolers clean. Teardowns are fewer and maintenance costs less. This is because Sun oils have a natural detergent action that prevents the formation of sludge and aids in removing any deposits that exist.

Can Handle 95% of All Quenching Jobs

Tests show that Sun Quenching Oils give better all-around results. For one thing, they assure hardnesses far above the commonly accepted minimum requirements. In any system that provides normal agitation, they can handle 95 per cent of all quenching jobs.

for the past five years the casing has been successfully made from plain carbon steel in the Ambridge, Pa., plant of Spang-Chalfant Div., National Supply Co. It is estimated that over 300,000 lb. of molybdenum and nearly 1,500,000 lb. of manganese have been saved by the conversion. Properties of the rereplacement steel are equal to or superior to the material previously used, as a result of heat treatment.

The carbon steel pipe is heated to 1600°F. preparatory to quenching and tempered at 1050°F. to 1250°F. depending upon the exact chemistry of the steel being treated. Through this treatment these minimum property requirements are met:

Yield Strength	80,000 psi
Ultimate Tensile Strength	100,000 psi
Elongation in 2 in.	16%

(Abstracted from "Gas Fired Furnaces Help Save Critical Material," Fred H. Bremmer and F. J. Zehnder, *Steel Processing*, December, 1952.)

Repin Furnace Belts to Save Alloys

A recent bottleneck has been the shortage of alloy links used to make conveyor belts in certain types of heat treating furnaces. Lack of links has kept many furnaces idle.

Commonwealth Industries, Inc., Detroit, in its atmosphere hardening furnaces used belts 36-in. wide and 50-ft. long. The links are 35-15 alloy (Standard Alloy Co.) and are pinned with a similar material.

A combination of higher than normal temperatures (1650°F.) and the cyanide atmosphere shorten the belt life to about 6500 hr. An examination of ruined belts revealed that nearly 90% of the links were still in good condition and available for further use. Most of the wear was in the pins.

(Continued on page 36)

Two Salem Gas Annealing Furnaces—Model 501

1 H.P. Induction Motor drives metal conveyor 21" wide with electric control panels. Each unit occupies a space 7½ ft. wide x 26 ft. long. Capacity—3,475,000 BTU or 3,000 cu. ft. per hr. Each unit is connected to conveyor 13½" wide x 10 ft. long. Excellent condition. Priced to sell.

Contact: W. Furlong, Gibson Mfg. Corp., Longmont, Colorado.

Sun Quenching Oil

Sun Quenching Oils Reduce Operating Costs

Sun oils thin out when heated, drain off parts faster and more completely. Dragout is reduced to a minimum. They do not thicken up, and under normal operating conditions need never be replaced. For more information about Sun Quenching Oils, call your nearest Sun office or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. MR-3.

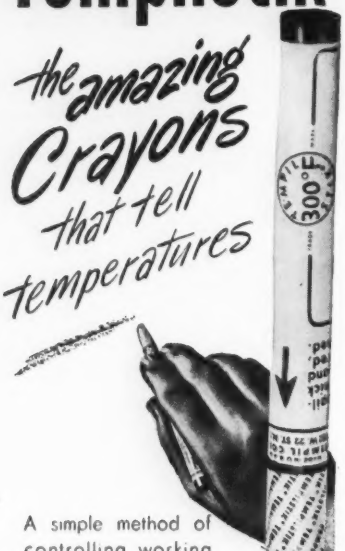
INDUSTRIAL PRODUCTS DEPARTMENT
SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

Tempilstik®

the amazing Crayons that tell temperatures



A simple method of controlling working temperatures in:

- WELDING
- FLAME-CUTTING
- TEMPERING
- FORGING
- CASTING
- MOLDING
- DRAWING
- STRAIGHTENING
- HEAT-TREATING IN GENERAL

It's this simple: Select the Tempilstik® for the working temperature you want. Mark your workpiece with it. When the Tempilstik® mark melts, the specified temperature has been reached.

$2 each

gives up to 2000° readings

Available in these temperatures (°F)

113	263	400	950	1500
125	275	450	1000	1550
138	288	500	1050	1600
150	300	550	1100	1650
163	313	600	1150	1700
175	325	650	1200	1750
188	338	700	1250	1800
200	350	750	1300	1850
213	363	800	1350	1900
225	375	850	1400	1950
238	388	900	1450	2000

Also available in pellet or liquid form.

FREE —Tempil® "Basic Guide to Ferrous Metallurgy" — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

METAL & THERMIT CORPORATION

100 EAST 42nd STREET
NEW YORK 17, N. Y.

LETTERS TO THE EDITOR

Dear Editor:

At the suggestion of Mr. Horace C. Knerr, president, METLAB Company of Philadelphia, I am writing to tell you about the American Ordnance Association and its work for the national defense. Our Association is now in its thirty-fifth year. Naturally, being devoted to the advancement of ordnance for our Armed Forces, it has deep concern for all phases of metal operations including heat treating.

Mr. Knerr suggests that our Association keep in close contact with the Metal Treating Institute and your publication "Metal Treating." I want you to know that we will gladly cooperate in every possible way. Please know that we value most highly the importance of your industry, not only for what it means in our peacetime advancement but for its importance to our national defense.

LEO A. CODD
Executive Vice President
American Ordnance Association
Washington 6, D. C.

Dear Editor:

I am deeply interested in receiving 2 copies of the proposed Apprenticeships Standards Training Program for the Heat Treating Trade.

This, I believe is a move in the right direction. We have training programs for a number of the other metal working trades, but this is the first attempt to train apprentices in the Heat Treating Trade.

The heat treating usually done in most small industries, is like Topsy, "It just growed."

I have long felt that the Heat Treating craft has been too much neglected. To too many metal workers all the heat treater had to know was to put a piece of steel in the furnace and heat it to a bright cherry red (whatever that is). Is it necessary for the heat treater to carry a basket of cherries to his place of employment, compare the heat of his furnace with the red color of the basket of cherries so that he may know when the steel is at the hardening temperature?

It seems to me too many furnace manufacturers have overlooked this fertile field of promoting the sale of their product. The management and supervision in many industries have looked upon heat treating as the simplest kind of a task, which required no training whatsoever. The poor guy who did the heat treating had equipment which was obsolete and worn out and down in some dirty corner of the shop which was not regarded to be useful for anything else but do the hardening that was absolutely necessary. If the poor devil hardened a piece or a part and it cracked in the hardening, regardless of how it was designed, he was forever damned. If the part or piece was broken through misuse it was "Too Hard" and the heat treater did a rotten job.

AMOS D. McGARY
Instructor of Metallurgy and Heat Treating
Atreus Wanner Vocational School
York, Pennsylvania

Dear Editor:

I would like to request the addition of my name to your mailing list on "Metal Treating."

I am a Development Engineer employed by East Coast Aeronautics, Inc. and would like to keep up with all new developments on heat treating. It would also be to my advantage to know the locations of qualified Heat Treating concerns.

STANLEY S. SKLAROW
Development Engineer
2719 Morris Avenue
Bronx 68, New York

Dear Editor:

Recently I received a copy of the September-October 1952 issue of "Metal Treating." This certainly is a very interesting publication so was wondering what action should be taken in regard to my entering a subscription for same so that I will regularly receive this magazine.

Trusting that everything is going along satisfactorily, and with my very best wishes I am,

A. H. d'ARCAMBAL
Vice President-Consulting Metallurgist
Pratt & Whitney
West Hartford 1, Connecticut

Manufacturers' Literature . . .

The literature listed below contains information of interest to heat treating organizations. For your copy write direct to the manufacturer and be sure you mention seeing it reviewed in "Metal Treating."

PRINCIPLES OF HEAT TREATMENT

The Meehanite Metal Corporation, New Rochelle, New York, has announced publication of a new booklet entitled, "Principles of Heat Treatment." Annealing, hardening, martempering, austempering and surface hardening are explained in detail through the use of numerous charts and photographs, as they pertain to Meehanite metal. Equilibrium diagrams, dilatation curves, "S" curves and Jominy curves, with their explanations, are included.

The 43-page booklet also contains illustrations of the use of heat treated Meehanite castings in a variety of engineering applications.

* * *

CARBURIZING AND HEAT TREATING COMPOUNDS

American Cyanamid Company, Industrial Chemicals Division, 30 Rockefeller Plaza, New York 20, N. Y. has published an illustrated booklet to show, through case histories, how a number of operating and treating problems were solved with the use of Cyanamid chemicals. Among the problems included are scaling, distortion, non-uniform case and insufficient hardening.

Also included in the booklet are descriptions and properties of Cyanamid carburizing and heat treating compounds.

* * *

MODERN METAL PROCESSING

"Annealing of Malleable Iron" and "Heat-treating Equipment for Aluminum" are two new bulletins recently announced as available from the General Electric Company, Schenectady 5, N. Y.

Designated as GEA-5797, the 12-page, two-color booklet on the annealing of malleable iron employs photographs and diagrams to explain how to cut down over-all costs and how to shorten annealing cycles. It discusses the effects of temperature and analysis on the annealing cycle and describes the various types of furnaces which may be used in the process, including elevator, bell, roller-hearth, and pusher-tray types. The bulletin also contains a sample chart for use in analyzing annealing costs.

"Heat-treating Equipment for Aluminum," designated as GEA-5912, is an eight-page, two-color brochure that describes the process of solution heat-treating, annealing, aging, and stabilizing of aluminum. Using a picture-story technique, it is divided into sections on the heat-treating process, heat-treating equipment, and selection of furnaces.

BATCH PRODUCTION HARDENING FURNACES

Gas-fired, batch type hardening furnaces are featured in a new illustrated bulletin just released by Surface Combustion Corporation, Toledo, Ohio.

Direct-fired, horizontal hearth types and circular and rectangular salt pot types are included. Also shown is a complete line of controlled atmosphere equipment for hardening. This includes individual prepared atmosphere generators, horizontal and vertical muffle furnaces, and the new "Allcase" high production furnace incorporating radiant tubes, recirculating fan and a totally enclosed oil quench.

* * *

METAL CLEANING

A 42-page booklet entitled, "Some Good Things To Know About Metal Cleaning" has been published by Oakite Products Inc., 19 Rector St., New York 6, N. Y. It covers a wide variety of cleaning operations and offers useful information on the removal of all types of surface contamination including scale, oil, corrosion and paint.

The use of over 50 Oakite materials is shown in the step by step descriptions of cleaning and surface treatment operations.

(Continued on next page)

HARDENABLE FERRITIC STAINLESS STEELS

A new bulletin on two stainless steels for tubing applications, which can be hardened by heat treatment, is offered by Babcock and Wilcox Company, Beaver Falls, Pa. These steels can be heat treated to develop good mechanical properties while offering corrosion and oxidation resistance.

Also included in the bulletin are condensed technical data on corrosion resistance, forging, machining, welding and physical properties.

CARBONITRIDING FURNACES

A four-page bulletin describes the new Gas Fired Vertical Radiant Tube Furnace, manufactured by Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, Ill.

The new bulletin contains a listing of design and application features, photos and diagrams of this radically new furnace which may be used for carbonitriding as well as carburizing, annealing, carbon restoration and other hardening jobs.

FREE-VANE CONTROLLERS

Free-Vane air operated controllers are described in a new 32-page bulletin, No. A120, published by The Bristol Company, Waterbury, Conn. Instruments for automatic control of pressure, temperature, liquid level, flow, humidity, pH, and electric variables are described. Among the new products shown are time-program controllers and electronic Dynamaster Potentiometers and bridge instruments in air-operated control models. The fully illustrated bulletin gives complete data on on-off, proportional, reset, derivative, reset plus derivative, and autoset types of controllers.

Just published is another new bulletin describing Free-Vane Electronic Pyrometer Controllers. It illustrates the unit plug-in construction of the new controllers and describes their use for low-open, high-open, low-high, low-open-high, and low-normal-high control. A model for proportional input control action is also described. The bulletin, No. P1248, contains complete specifications and full size reproductions of actual temperature scales.

To rebuild a belt, it is taken apart by melting out the pins with a cutting torch. The belt is cut into 4-ft. sections for easier handling and the bad links removed. Later the old and new links are reassembled to make a good-as-new belt. Care must be taken to use the new links together and to put old pins back in their same relative positions.

Cost of repinning varies, but a 50-ft. belt should average somewhere near $800 for materials and labor and a job can be completed in about 5 days. In a belt of this size, about 3000 lb. of alloy can be saved in many instances.

(Abstracted from "To Save Money, Conserve Alloy, Repin Your Furnace Belts," Roger Williams, *The Iron Age*, August 16, 1952.)

Carburizing of Steels

The carburizing of steels to provide a material that has a hard surface backed by a strong or ductile core is one of the oldest procedures in the treatment of steels. Until recently, carburizing was also one of the least carefully controlled and least understood of the processes. There are several methods of carburizing, all of which have certain advantages and limitations. They include pack carburizing, gas carburizing and liquid carburizing.

There are many things to watch for in carburizing either to prevent defects in the parts or to overcome faulty work practices. Among them are:

Variation in the depth of case in pack carburizing can result from the improper packing. A free flow of gas to all surfaces is essential to uniform cases.

Soft spots can result from steel quality or abnormality, phosphorus segregation, unevenness of carburization and flame impingement on the part.

Sooting in gas carburizing can interfere with effective carburization in addition to spoiling appearance of the work.

Stop-off defects are usually due to the use of a copper plate that is too thin to offer complete protection from gas penetration. Copper migration can also prevent the proper carburization of parts near the stopped-off area.

Improper heat treatment after carburizing can cause poor performance of the part. If the carbide network which results from slow cooling in some steels is not destroyed, the case will be brittle. Too, if the core is not heat treated properly, it will be too weak to support case and result in cracking.

(Abstracted from "Carburizing of Steels," John Everhart, *Materials & Methods*, October, 1952.)

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This rocker arm is used in refrigerator temperature control units. It is made of C 1010 steel, liquid carburized in AEROCARB E&W at 1600°F and oil quenched. Case depth: 0.005 inches. Hardness: 80 Rockwell 15N.

This swivel pin for oscillating fans, made of C 1117 steel, is also carburized in AEROCARB E&W at 1600°F and oil quenched. Case depth: 0.020 inches. Hardness: 80 Rockwell A.

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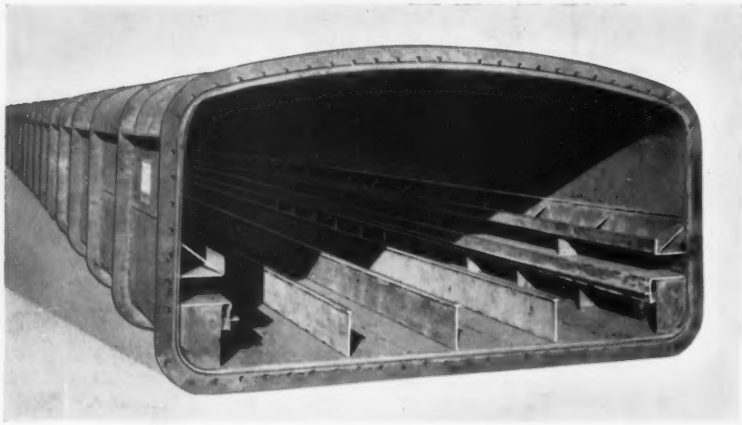

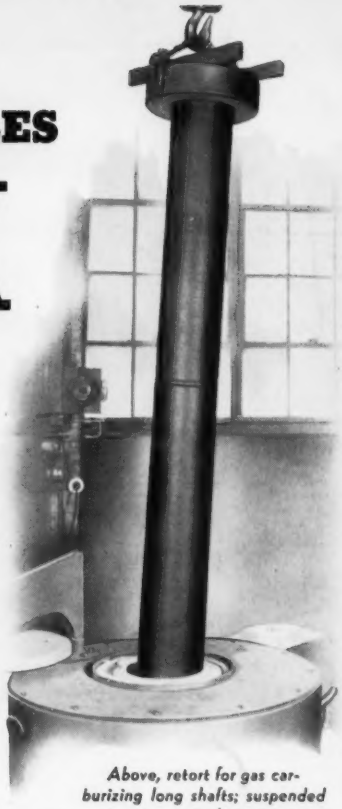

Above, retort for gas carburizing long shafts; suspended to prevent distortion.

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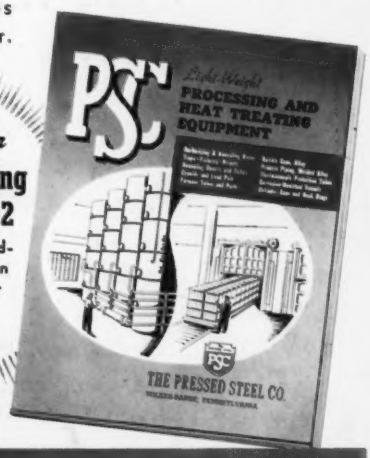

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